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ABSTRACT

This proceedings provides the texts of opening remarks, the official welcome, and 37 papers presented at an international symposium on the theme, "Computer Conferencing: Allied Technologies and New Applications." The papers are divided into seven categories: (1) Distance and Adult Education; (2) Socio-Psychological Issues; (3) Computer Conferencing Applications; (4) General Educational Issues; (5) Electronic Conferencing and Beyond; (6) Electronic Message Interchange; and (7) Research Applications of Computer Conferencing. The text is supplemented by various figures, and most papers have reference lists. (EW)

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THE SECOND GUELPH SYMPOSIUM
ON
COMPUTER CONFERENCING

JUNE 1-4, 1987

UNIVERSITY OF GUELPH
GUELPH, ONTARIO, CANADA

PROCEEDINGS

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Second Symposium on Computer Conferencing: Allied Technologies and New Applications

June 1-4, 1987
Guelph, Ontario Canada

Opening Remarks by the Symposium Chairperson

Dr. Elaine K. McCreary,
University of Guelph

Good morning everyone!

Bonjour encore à ceux qui étaient ici avec nous hier pour l'atelier; et à ceux qui viennent d'arriver: soyez bienvenus a l'Université de Guelph, en Ontario, Canada.

We are delighted and honoured to have assembled here much of the talent that is moving forward the cause of computer-mediated communication in Europe and North America--and by virtue of personal networks extending CMC throughout the world.

Like those fortunate people who participated in the early days of telephone, radio and flight, we sense that with CMC the social order has once again changed irrevocably.

It is important for us to realize that this mode of human interaction is being discovered concurrently by professionals who previously worked in isolation from each other -- and who still operate from within very different perspectives.

Chacun d'entre nous a developpé une compétence, une expertise dans un domaine particulier. Mais aujourd'hui nous amènons les téchnologies de l'information, de l'enseignement et des communications électroniques à une nouvelle convergence.

What we engage in now results from the merging of several precursor technologies including information technology, educational technology and communication technology.

Furthermore, in themselves, these constitute only the products contributed by much longer lines of separate enterprise in the areas of information science, philosophical structures of thought, the nature of human learning processes, and inter-human communication (the latter sometimes referred to as "data base merging between carbon units"!).

Here at Guelph, we are proud of the fact that a multidisciplinary approach has been exercised to some degree, first of all in a loosely knit cross-college research group that enables discussion among people working in virtually all colleges of the university.

And secondly, in the Steering Committee of this Symposium, which I would like to introduce to you now.

May I first present Dr. Ab Moore, Chairman of the Department of Rural Extension Studies. Dr. Moore's professional training is in Educational technology and while our graduate program in Extension Education has traditionally trained people for service in the non-formal education of adults in Canada and around the world, the program now explicitly includes the role of communication technologies in extension work.

Many of you know Mr. Bob McQueen of Communication Services to whom we are indebted for launching the first Guelph symposium on Computer Conferencing in 1985. Bob's background is in business management and administration. Since returning to Guelph from Australia he has been very active with the Cosy Development Group and will often be available to you this week in the demonstration room 004.

We are extremely well represented from the Department of Computing and Information Science by Drs. Ted Swart and Tom Carey. Ted Swart has cultivated several careers in chemical engineering, physical chemistry, mathematics, and computer science. It was Ted who selected and supervised the team that undertook initial development of Cosy here, and he maintains an active interest in the techical support aspects of inter-personal computing. Tom Carey's work has been in software engineering particularly as it applies to automated office systems and to cooperative work groups.

Dr. Stuart Hunter of the Department of English is a self-described amphibian: regarded as a literary-type by techies, and a techie by literary types. He serves as V.P. of the Ontario Consortium for Computing and the Humanities, and as chair of the Educational Network Task Force here at the University-whose concern is to integrate all on-campus computer-based learning facilities into a single system.

Jim Angel - an M.Sc. candidate in Rural Extension Studies worked with elementary classroom computers in Northern Ontario, and is now concerned with communication networks for remote areas.

The steering committee has also benefitted from consultation with Dr. John Black, Chief Librarian and Ellen Pearson, Associate Librarian of Guelph's outstanding academic library.

My own research has been focused on the information gathering activities of advocacy groups -- an application that is anchored in non-formal adult learning but has equal parts of information science with social change and development processes.

Agricultural, economic and social development, as you probably know, is the hallmark of the University of Guelph.

My purpose in presenting the steering committee to you in this way has been to illustrate the range of professionals who have a proprietary interest in this new mode of human interaction. It does not belong to any one of our factions. But rather constitutes the new town square, the new common ground on which we can meet to conduct the business of humanity. If this is the destiny of CMC then each little thing we do to forward its application, is important work.

Personal Introduction:

And now -- to welcome you on behalf of the University as a whole, may I present Mrs. Margaret Beckman, currently Executive Director of Information Technology at the University of Guelph.-- Formerly Chief Librarian under whose leadership Guelph developed an automated library system which has since been sold around the world.

-- For many years she was chairperson of the National Research Council of Canada's advisory board on scientific and technical information.

-- and in 1986 she was named Academic Librarian of the year by the American Library Association.

Alors, mesdames et messieurs, c'est mon plaisir à ce moment de vous presenter, la Directrice Executive des Technologies de l'Information à l'Université de Guelph, Mme. Margaret Beckman.

The Second Symposium on Computer Conferencing
University of Guelph

Welcome: June 2, 1987

Margaret Beckman
Executive Director for
Information Technology

It is a great pleasure to welcome so many distinguished visitors to the University of Guelph, to participate in the second Guelph Symposium on Computing Conferencing. So much has been accomplished in the brief two years since our first conference that it is difficult to appreciate the speed at which advances are being made. But I don't need to tell all of you that.

Elaine McCreary, your conference chairman, suggested that it might be useful if I explained the information technology environment here at Guelph, and the role that computer conferencing plays within it.

The Senate of the University adopted a strong statement for information technology in April 1984, when it approved goals that envisaged the integration of information technology into all aspects of the Guelph academic environment, for faculty, staff and students. The past two years have seen the technical and organizational foundations laid for support of such an environment with the implementation of an integrated communications network for the entire campus based on a Rolm switch, and the acceptance of a strategic plan for information technology which will provide direction for the future.

Basic to that strategic plan is a philosophy of coordination: through information technology committees within each college; through a Senate Committee for Information Technology called SCIT, on which the chairman of each College Committee is the representative; through Task Forces which address all major areas of concern, whether plans for future central computing capacity or standards for local area networks; and through project and management teams for all major university information or administrative systems such as personnel, payroll, budget, student services, etc.

Underlying this coordination - in fact absolutely essential to its success- is the Guelph conferencing system, CoSy. The first action of any committee in the information technology area is to create a CoSy conference for that Committee, usually subdivided to reflect minutes, agenda, and discussion topics. The Senate Committee for Information Technology, SCIT, was the first to win acceptance of its minutes as approved through the CoSy medium. A year later this is a standard procedure for other committees as well. Another breakthrough was agreement that the agenda, minutes and discussions within the SCIT conference could be open to the whole campus. A second conference was created, SCITO, for SCIT - Open, which allows all CoSy users, including students, to participate in the Senate Committee affairs. This input has been invaluable. Equally valuable, however, is the credibility that has been created for information technology and the understanding and approval that has been engendered, as a sense of ownership of information technology has replaced a traditional resistance to change.

Students have been among our strongest supporters for the openness which the conferencing system has brought to the whole thrust of information technology on the Guelph campus. In addition to its impact on our ability to effect the coordination which I have just described, CoSy is also being used in the teaching environment. The relationships of student to student in small seminar or project groups, or of student to faculty in a counselling mode has been enhanced. And as you will learn from some of the sessions in the next few days, many of these applications of conferencing to the teaching environment are serving as the basis for research projects.

This has provided a very quick glimpse of the Guelph information technology environment, and the role which computer conferencing plays in it. We are looking forward to learning much from the conferencing background which you all are bringing with you to this symposium, and we thank you for coming and sharing your ideas and experience. Welcome to the University of Guelph, and enjoy your time with us.

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DISTANCE AND ADULT EDUCATION

Distance Teaching Techniques Using Electronic Conferencing

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Rochester Institute of Technology

Second Symposium on Computer Conferencing and Allied Technologies
University of Guelph, Guelph, Ontario, Canada
June 1-4, 1987

ABSTRACT

This paper describes use of computer-based communications to improve student-teacher interaction in media-based courses at Rochester Institute of Technology. The system uses remote PC to VAX communications via telephone lines to access communications, mail and conferencing software. Faculty and staff involved with the design and instructional application of this system offer observations to others involved with this technology. The appendix contains a student user manual for the system.

WHY COMPUTER COMMUNICATIONS?

Distance or open teaching techniques allow institutions of higher education to be responsive to the needs of growing numbers of adult, part-time and non-degree learners. Rochester Institute of Technology offers distance education in the form of telecourses to approximately 700 students each year, delivering instruction via print and video and supporting communication via mail and the telephone. However, communications difficulties between these learners and their instructors, advisors and other students continues to present a barrier to these students' success. While on-campus students obtain answers to simple questions by going to an instructor's office, walking to the bookstore or asking a classmate; off-campus, part-time learners who work, care for children or have limited mobility, find it difficult to obtain answers to even easy questions. These learners telephone their instructors, write their advisors and drive to campus after work, only to fail to get timely answers to their questions, sign up for the wrong course or arrive at the bookstore an hour after it closes. And, as significantly, the benefits to be derived from "classroom" discussions are generally lacking or minimal in distance education.

Unhappy with the limited communication capabilities available to its telecourse students, staff members decided to augment the existing telephone and mail channels with computer-based communications. By incorporating communication between remote PC's and campus computers, RIT sought to add the following features to telecourse communications:

- Time independence. (Students and instructors communicate at times convenient to each.)
- Place independence. (Any place with a PC and a phone line can serve as a conference center.)

- Interactivity. (Communication is viewed interactively as read, write and respond.)
- One to one and many to many. (CBC more flexibly supports broadcast, narrowcast and targeted communications.)
- Written record. (All communication is available for subsequent editing, reuse and analysis.)
- Handicapped accessibility. CBC is uniquely open to those with limitations of perception, such as the deaf and blind, and those with limitations of mobility, such as the homebound and wheelchair bound.)

RIT'S SYSTEM

Recognizing the power of computer-based communications (CBC) to support the instructional and informational needs of distance learners, faculty and staff from several departments at Rochester Institute of Technology (RIT) designed and initiated a computer-based communications system. The system has been in use since summer 1986 and has been used in three different telecourses. The RIT computer-based communications system was not developed as a means of delivering instruction (i.e. Computer Based Instruction or Computer Assisted Instruction, although a course may include some CBI or CAI modules), but rather as one communication link within a larger instructional system where course materials are usually delivered through some other means (i.e. video, audio, print, lecture). The pilot courses are "Modern American History" and "An Introduction to Microcomputers." These courses are media-based instruction, in which the learning material is presented via print, audio and videotapes, and student-teacher communications are handled over the telephone, mail and or weekly meetings.

Unlike systems emphasizing single capabilities such as on-line testing or electronic messaging, the RIT system provides an easily used tool for various types of learner-campus dialogue. Using personal computers and modems, learners are able to create and submit homework; receive feedback; interact with their instructor and others; and access software, library resources and advisory information.

SYSTEM DEVELOPMENT

Two observations guided the design of this instructional communication tool, a) distant learners are largely denied the rich, interactive environment of information available on campus, and b) highly effective instructional materials presently available for distant use lack a powerful tool for two-way communication. These observations coupled with university-feasibility factors produced a set of design requirements for a computer-based communication system for telecourses. First, it had to address the actual needs of distant learners and provide something that could not more easily be provided in another way. Second, it had to be sufficiently standard to be applicable in other (non-telecourse) environments. Third, the RIT communication system had to accomodate complex and emerging educational tools such as concurrent conferencing, access to external databases, electronic blackboarding, on-line catalogs, access to videodisc archives and the like. Finally, the system had to be inexpensive (i.e. tools already in place, to a large degree).

Our inquiry into computer-based communications systems used at other institutions revealed that none of these systems could be easily adopted by RIT nor were they sufficiently full-featured to serve the needs of distant learners. However, an examination of existing software revealed much that would accomplish the goals of instructional dialogue and learner information. To a large extent, the RIT system is based on adding shells, menus and convenience features to existing software, rather than writing new programs. We purchased one major piece of software (the NOTES conferencing program), but most of the core utilities are in the public domain or are supplied as a part of the VAX/VMS operating system. The CBC system at RIT builds upon existing research and seeks to strengthen, through improved communication, instructional materials and strategies already developed and in use. It also attempts to make the power and convenience of asynchronous computer communications easily accessible to faculty and learners in all disciplines, not just computer courses.

The development of a CBC system required solving several key problems. Response from telecourse students, with whom this system was to be used, revealed that access to personal computers was not a problem. The primary issues that were addressed included: the selection of affordable software for the main computer, programming and design of effective menus, selection and distribution of PC communications software and modems, development of good documentation, and faculty training.

Components of the RIT system include:

- VAX host computer (VAX Cluster) running VMS.
- Software components supporting the capabilities of the system (e.g. NOTES, MAIL, PHONE, Lab Submission, Library Catalog, etc.).
- Personal computers, modems and software (communications and VT-100 terminal emulation, primarily KERMIT) for remote students and faculty.
- Training materials including How-To manuals for students, instructors and system administrators (see attached materials).

RESPONSE TO COMPUTER COMMUNICATIONS

Student

The following comments were offered by students who utilized the CBC System in two telecourses at RIT.

I *found this method of teaching very convenient. I did not speak much in the computer conference, but that's how I am in a regular class.*

I want to say that this course would be excellent for someone who has more self discipline than me, or someone who has a home computer. That would have helped. I am not on campus much, so, I have to force myself to go which I am not good at doing.

This method is much better for a subject such as history, a typical classroom course is too restrictive. It usually is scheduled for one evening a week which is much too long (4 hours long). This type of class allows the student to study at his own pace.

I think this form of telecommunications is a nice "window to the world." I fully intend to make use *of the RIT VAX now that I have gotten "CONNECTED." I'm currently involved in 4 or 5 useful/interesting teleconferences on it.*

I would like to learn to use all the facilities available from the RIT VAX; for this I will need a lot of help. Each week or two there should be a workshop in conjunction with the course topic so that faster learning would take place.

I didn't encounter any difficulties other than what AT&T caused.

My biggest obstacle was hooking (or trying to hook up) a modem to my computer at work (the infamous and not so compatible Wang!) Not being able to do this initially and spending so much time on trying to make it work (along with help from XXX and YYY) set me back in my assignments. I know it's impossible to have the correct equipment for all types of computers to hook up modems to, and I know that loaning out modems is a new idea with this course, and I feel that there is really no alternative to actually doing it rather than just reading about it.

MAIL, NOTES and library and outside infobases were important to me as a student and as a working professional. I think that every student at RIT should know how to access the library and to use MAIL and NOTES. I was especially interested in MAIL as our agency hopes to connect the central office with all the regional offices and I hope to help them develop a MAIL capability. I also would like to learn more about the NOTES conferencing system so I can talk more with students and professors to find out more about computers and ask questions that may come up in the future.

Faculty

The following observations are offered by two instructors who utilized computer conferencing and computer mail as communication tools within their media-based courses.

Comments from the Instructor
Introduction to Microcomputers

I teach a print and video-based telecourse titled Introduction to Microcomputers. Students in this course are shift workers, mothers with infants, school teachers, retired people and traditional students trying to squeeze in another course. Students are required to own or have access to a microcomputer and are assumed to be willing to confront computer technology.

The computer-based communication system described in this paper was adopted as a required part of this course and was utilized for student-teacher interaction, assignment submission and feedback, and class discussion via conferencing software.

After two quarters, my opinion is "It's worth it, but we underestimated its difficulty and frustration." For my own benefit and for others reckless enough to adopt a similar system, I offer some observations:

- *Acknowledge that PC to AT&T to VAX communication is complex, opaque and mysterious.*
- *Praise every small step that a student takes.*
- *Provide prompts, labs, experts, handouts and handholding.*

- *Require standardization on the PC side (We want VT100 emulation, Hayes command set, and MS-DOS or Macintosh computers.)*
- *Expect every PC system (including its user) to be different from every other PC system and will require individual and informed attention to bring it on-line.*
- *Expect the worst from the large system (installation of a new phone system, hardware anomalies, inscrutable system messages).*
- *Remember that this is a new medium and that people don't know how to talk this way. (Conferencing is especially new and frightening.)*

In spite of the difficulties suggested by these observations, I also remind myself of the advantages of computer-based communication to myself and my students.

- *Fast interaction with students. (Contrast with the week required for paper mail and the frustration of telephone tag.)*
- *Efficiency tools like distribution lists, storage of all communication, editing and processing capabilities.*
- *Freedom to talk/write to students from home without missing the Bill Cosby show.*
- *Bias-free communication, not knowing the other person's age, sex, race or background.*
- *Using and learning about a communication medium relevant both to course content and to my interest in educational technologies.*

Comments from the Instructor

Modern American History

For several years I have been teaching "Modern American History" using media presentations augmented by classroom discussion sessions. This past quarter, I replaced the classroom component with computer-based communications. I offer the following comments as one instructors field notes.

As a result of my experience with teaching a computer conference assisted telecourse, I have come to the conclusion that computer communication can be a link between people instead of a barrier to communication. I found that because the participants in the conference and on mail were always identified, it was easier to remember who they were and develop some sense of personal relationship. I encouraged them to alter their mail and notes names to carry some personal, first or last, name. I felt that this facilitated personal awareness.

I read their replies several times each day and added my own comments so that there was considerable interaction. For the most part the students were reacting to my discussion questions rather than interacting with each other, but I did try to comment on replies where it seemed helpful and appropriate.

I also had a batch mailing list of the whole class and sent mail messages two or three times a week. I think this added another personal touch. Sometimes, instead of posting a comment on a reply, if it seemed fairly personal, I sent a personal mailing to that student. Also, several of them sent me mail messages weekly, and I always sent some reply, even if short, to increase the sense of personal *response. The result was that both the students and I felt that the level of personal interaction was higher than is often the case in a live class setting.*

Because I had access to computer and modem both at home and in the office, I was able to make many short check-ins without it being a hardship. I often took 5 minutes in the evening, or a couple short check-ins on Saturdays and Sundays. It was not as intrusive as the phone ringing while I was in the middle of doing something. Rather, I could take a short break even during television station changes, log in, read and reply, but at my convenience. I could also be contacted easily by mail. Often when I am phoned and not available, someone leaves a message and number. When I return their call, they are out! With mail, the message is not left with any third party. I check at my convenience, send a reply, and do not have to be concerned as to whether the other party is available or not. It has as much speed as phone contact but with less interruption and inconvenience.

The real difficulty is getting the student over the preconception that the computer is alien, difficult and depersonalizing. Several of the students indicated that it was easier to participate than in the live class setting. Certainly, I found it easier to be more direct and personal on occasions when it seemed suitable.

I have not been using this method this past quarter and, frankly, miss it. I hope to be able to cultivate the procedure and find a growing number of interested and willing students in future years.

SUMMARY AND FUTURE APPLICATIONS

Rochester Institute of Technology continues to develop an asynchronous, computer-based communications system to serve the special needs of distance learners. Remote, working adults now have a tool with which to freely interact with their instructors, advisors and fellow students, regardless of time, place and mobility constraints.

Expansion of this system will present increased opportunities for learning, access to information and participation of distance learners. When used as a support system for telecourses it permits faster submission of assignments and feedback on homework, more frequent learner-teacher contact, and learner-learner interaction. The system can also increase opportunities for outreach to hearing impaired or otherwise disabled learners. Another use is as a follow-up to short-term training, providing access to instructor and participants for questions and discussion. And it could permit increased enrollment in high demand courses in an overflow or distributed manner.

RIT's immediate plans for the system include the addition of a full-featured information data base with touch tone access using a speech synthesizer. Use with a course composed entirely of hearing impaired students from RIT's National Technical Institute for the Deaf, taught by a visually impaired instructor, is also under development as well as remote delivery of a graduate degree program. Additional faculty training workshops are being scheduled to broaden the use of the system.

Problems which continue to be addressed include:

- How can we make it much easier to use?
- How can faculty training best be accomplished?
- What are the advantages of a menu versus a non-menu system?
- What common-denominator of equipment can be expected for students?

- How much computer competence can be required for a non-computer course?

- To what degree should these systems cater to the non-traditional student?

Although tempered by the real problems confronting the use of computer communications, the two faculty who have been involved with the project are more enthusiastic about the potential of the system than they were when we began and general campus interest in using the system has been high.

We found that developing a system for computer-based communications at RIT was relatively straight-forward, inexpensive and uneventful. The system has given us another communication channel, with some limitations (primarily in user training) but with some structural superiorities over video, mail and the telephone. Although telecourses at RIT function well without this technology, we believe distance education is more individualized, more responsive and more interactive through the addition of computer-based communication.

Facilitation of Adult Learning Through Computer Conferencing

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ABSTRACT

This paper reports on the experience of offering two graduate level distance education courses through a computer conference. The design of the course is presented followed by an analysis of student participation, satisfaction, and achievement. The results are discussed in terms of different facilitation techniques and different learning styles.

LEARNING AND COMPUTER CONFERENCING

Use of Computer Conferencing for Graduate Education

Distance education is an important phenomenon in higher education in Canada as well as a number of other countries. Prior to the availability of computer conferencing, most distance education was structured as a set of readings and assignments. The student completed the assignments and returned them to the instructor for comment. Often, the grade of the course was based on an examination. This predominant pattern is essentially serial in its orientation. The instructor provides the structure of the course. The student completes assignments, and the instructor provides feedback. If the interactions are all through the mail, the feedback can be delayed for several weeks.

Some distance education designers have attempted to enrich courses by provid- ing audio tapes, including telephone contact between student and instructor, or organizing students in groups and conducting discussions through tele-lecture equipment. Nevertheless, the predominant pattern is a one-to-one interaction between the instructor and the individual students. Distance education which includes student to student interaction is very rare.

The use of computer conferencing for distance education is a relatively new phenomenon. This methodology allows for the rapid interaction among students as well as between the student and the instructor. Thus, distance education courses, for the first time, can duplicate the seminar discussions found in advanced classes on campus. In addition, since the methodology does not depend on a number of students being in the same location, the distance education course can be offered to students at widely different geographical locations.

Description of the Course

In the past two years, we have been experimenting with computer conferencing as a form of distance education. The course being examined in this paper was designed to explore differing perspectives on community development as a type of non-formal adult education. It is offered through the Department of Adult Education and is taught by one of the senior faculty of that department.

The basic format of the course is for the class to meet twice in face-to-face meetings: once at the beginning and once at the end of the course. The first meeting is designed to introduce the course to the students, to deliver course materials, and to train students to use the Participate computer conferencing system (Participation Systems, 1985) and the DATAPAC network. In addition to reference materials regarding the Participate system, students are given course notes and texts for the course at this first meeting.

The students are expected to read course texts and articles, discuss the ideas in an on-line conference, and to write two short essays during the course. These essays are sent to the instructor on-line and with the permission of the students, are made available for other students to read. The basic ideas in the structuring of the course are presented in Davie and Palmer (1984).

Discussions conducted by computer conferencing are similar to discussions held in a seminar room. Each student can read the contributions of other students and the instructor and make comments as they seem appropriate. There are some important differences, however. In the classroom, students who are able to think quickly and formulate their responses are advantaged as they can jump in when there is an opportunity. Students who are slower are not able to enter the conversation at an appropriate time and often do not contribute. In the computer conference, one can read the other contributions, consult reference materials, take time to compose a response and enter the response without the pressure of the on-going discussion. Thus, there is an equity that is often missing in the face-to-face discussion.

On the other hand, computer conferencing discussions, are all text based. Effectiveness in this medium might well be linked to a student's ability to write well. Powerfulness in the written medium is rewarded. This does not seem to be much of a problem in a graduate level course, but nevertheless, might well contribute to a differential response rate by students who feel that their skills at writing are more or less adequate than their colleagues.

In addition to the conference discussion, the computer conference can be used to transmit written assignments. This facility allows for rapid response from the instructor. In addition, assignments can be made available to other students to read. This is analogous to the seminar where students read their papers to one another, or where papers are duplicated for others to read. In this way, the individual analyses can be discussed and become an important part of the content of the course. Again, the medium places a premium on thoughtful contributions rather than quick off-the-cuff responses.

It is also possible to ask the students to work together to create joint papers. This paper reports two different, but similar forms of working together. First, the students were paired and asked to produce a joint paper outlining their values and beliefs about community development and to indicate where their ideas converge or diverge from each other.

The second form of working together is for a small group of 4 to 5 students to analyze a case study and present the analysis on-line. Again, the analyses are available for the other members of the course to read. This method is similar to working within the course as small groups. It has the advantage of assisting the students in their writing and giving each group sufficient time to develop an analysis in depth.

At the end of the course, a final face-to-face meeting is held to discuss the course experience. These meetings are tape recorded and the student discussion is used to understand the impact of computer conferencing on learning.

In the 1987 course, students were also administered a form of the Learning Styles Inventory originally designed by Kolb and Fry (1975). Differences in learning style preferences are examined and related to the course experiences.

At the time this paper is being written, the second course is still underway although it will be completed by the time of the conference. Thus, some of the data are still tentative.

Design of Computer Conference

The computer conference for the course was divided into the following sections (branch conferences) for clarity:

Community ---- The main conference in which the topics are discussed.

Introductions -- A branch conference where students introduce themselves.

Help --- A branch conference with advice on the Participate system.

Ye Olde Town Square -- A branch conference for social chitchat.

Learning Partners -- A series of private conferences for learning partners to develop the first assignment.

Groups -- A series of private conferences for the use of the small groups partners to develop the case studies.

Assignment 1 - A branch conference to hold the texts of the first assignment.

Assignment 2 - A branch conference to hold the texts of the case study.

LEARNING STYLES

Introduction and Background

In the past decade the literature on learning styles has developed extensively. There are a number of competing schemes, but one of the most popular has been designed by David Kolb (1984). The application of Kolb's learning style model to adult education has been discussed extensively in Brundage and MacKeracher (1984).

Kolb's learning style model has two major dimensions: concrete experience -abstract conceptualization and active experimentation- reflective observation. These two dimensions form a cartesian coordinate system with four resulting learning styles. The first of these styles is labelled the accommodator and is high on concrete experience and active experimentation. The accommodator is strong on doing things, in carrying out plans and tasks and getting involved in new experiences. The accommodator seeks opportunity, risk taking and action. This style is called accommodation because it is best suited for those situations where theory or plans do not fit the facts. Where the theory does not fit the facts, the accommodator is most likely to disregard or reexamine the facts. People with an accommodative orientation tend to solve problems in an intuitive trial-and-error manner, relying heavily on other people for information rather than on their own analytic ability.

The second of these styles is called the diverger. This style emphasizes concrete experience and reflective observation. People with this orientation tend to have imaginative ability and awareness of meaning and values. Divergers tend to view concrete situations from many perspectives and organize many relationships into a meaningful "gestalt." The emphasis in this style is on adaptation by observation rather than action. People with this orientation perform better in situations that call for generation of alternative ideas and implications, such as a "brainstorming" ideas session.

The third style is labelled the assimilator. The dominant learning abilities are abstract conceptualization and reflective observation. The assimilator is strong in inductive reasoning and the ability to create theoretical models in assimilating disparate observations into an integrated explanation. As in convergence, people with this orientation are less focused on people and more concerned with ideas and abstract concepts.

The final style is the converger who has dominant learning abilities of abstract conceptualization and active experimentation. These individuals are strong in problem solving, decision making and the practical application of ideas. The converger is a person who seems to do best in situations like conventional intelligence tests, where there is a single correct answer or solution to a question or problem. Knowledge is organized in such a way that through hypothetical-deductive reasoning, it can be focused on specific problems.

Kolb argues that complete learning requires all of these abilities and one cycles through the styles as they learn. However, each person has a preference for one way of approaching learning, a dominant style. It is possible that individuals with different preferred learning styles may approach the experience of computer conferencing in different ways.

Learning Style Instrument

A simple, two page Learning Style instrument was used. It is a collection of nine sets of statements. The student gives a weight to each statement in each set. Each of the statements correspond to one of Kolb's variables (concrete experience, reflective observation, abstract conceptualization, and active experimentation). The weights are totaled and the resulting scores plotted to determine the student's preferred learning style.

The learning style instruments were sent to the fifteen students by mail two thirds of the way through the course. Four students were sent the instrument on-line, three because the instrument was lost in the mail and the other because the student is blind. The blind student has a Braille terminal and responded to the instrument on-line. In addition, five other students returned the data from the instrument on-line. Finally, one student did not return the instrument.

ANALYSIS

Analysis of Course Transcripts

One of the advantages of a computer conference is that the medium provides a complete transcript of the course interactions. Not only is the main discussion reproduced for further analysis, but each of the branch conferences are also available. Several different analyses have been made of the transcripts and the results presented in this paper.

The main conference was analyzed for:

(1) The number of contributions made by each participant;

(2) The number of references made to other contributions by each participant;

(3) The number of notes read by each participant on a weekly basis;

(4) The time when notes were entered into the system; and

(5) The number of notes that explicitly mention course readings or materials.

The learning partner conferences were analyzed for:

1. The number of contributions made by each participant;
2. The number of drafts of the paper entered;
3. The number of encouraging responses made by each participant;
4. The number of notes related to setting agendas or times of meeting; and
5. The time when notes were entered. In particular, it was interesting to note when students were simultaneously on-line compared to an asynchronous mode.

The small group transcripts were analyzed for the same items as the learning partner conferences.

Analysis of Learning Style Instruments

The learning style instruments were scored and a preferred learning style was plotted for each student. Learning partners and small groups were examined to see the similarity or difference of the preferred learning styles in each partnership or group.

COURSE OUTCOMES

Participation Frequency

There are two kinds of participation in any educational experience. In the classroom the student participates both when contributing directly to the discussion and by active listening. Similarly, in the computer conference course we can analyze participation either through an analysis of transcripts to determine the amount and kind of contributory participation or we can look at the records to see when students log in and read the conference.

In both courses, student reading of notes was quite active. In most cases, it appears that students log in and read the conference at least once a week, and many students log into the conference once a day. In the first course, computer records indicate that students spent about three hours a week logged into the conference. There were eleven participants in the 1986 course and by the end of the first week of the course, six of the eleven participants had successfully connected with the conference. Four additional students were added the following week, and the final participant logged in by the third week. The mean number of participants who signed on each week was 9.5 with a range from 6.0 in the first week to 11.0 for five of the 12 weeks of the course. The average number of notes for each week of the first course was 20.6

In the 1987 course, we originally had sixteen students. In the fourth week one of the students dropped out of the course leaving 15 students. Of these 14 had logged on during the first week and all had logged on by the end of the second week. Although the course is not yet complete, it appears as if every student is logging on at least once a week and most are logging in several times a week. Even though the course structure is different in the 1987 course, in that there is a good deal more activity required in the learning partnerships and in the small groups, the mean number of notes each week in the main discussion thus far is 21.0 which is quite similar to the mean for the 1986 course.

In the 1987 course two assignments were given which required cooperative writing by the students. In the first assignment, students were paired into learning partnerships and asked to write a joint paper. There were originally eight pairs, but one pair was dissolved when the student mentioned above dropped out of the course. Of the seven remaining pairs, five were active in writing the course on-line. While the remaining two pairs completed the assignment, they were not active on-line. Both of these two inactive pairs live together and completed the assignment off-line and sent the assignment as a complete piece. Analyzing the five on-line partnerships, we find that they required a mean of 28.2 notes to complete the assignment.

Synchronous vs. Asynchronous Participation

The analysis of the transcripts of the main conference and the learning partnerships indicate a number of interesting patterns. First, we should note that Participate is an asynchronous system. Except for a primitive facility for sending one line notes to other participants who are concurrently logged on to the system, all notes are written and posted to the conferences where they may be read at some other time by other participants.

Nevertheless, notes tended to cluster on certain days. It is as if the participants tended to like immediate feedback and worked on the computer at the same time. By examining the time stamp on pairs of notes, one can count the number of notes sent on the same day in comparison with the number of notes sent on different days. All notes sent on the same day as the preceding note were coded as synchronous, while notes sent on a different day than the preceding note were marked as asynchronous. This coding stretches the definition of synchronous, but it seems to reflect the orientation of the students who commented that they felt like they were working together.

In the main conference, there were twice as many synchronous notes as asynchronous notes. In the five active learning partnerships, the synchronous rate was even higher. The mean ratio of synchronous to asynchronous notes was 23.4 to 8.4 or about three to one. Clearly, one of the successful strategies for writing a paper together is to be on-line at the same time (or at least on the same day).

References to Other Notes and Course Materials

One of the problems in a classroom discussion is getting the participants to build on one another's comments. Too often, contributions tend to be disjointed. The experience in the computer conference is quite different. Student's tend to refer directly to other participant's notes. In the 1987 course a count was made of the notes that specifically referred to other notes. Out of 172 notes as of the first of March, 54 or 30% of the notes referred specifically to other notes.

Except for notes about course management, most of the discussion in the main conference dealt directly with the course topics. A count of notes relating directly to course readings showed that approximately 15% of the notes referred specifically to an author in the assigned readings. This statistic understates the case, as a great number of notes referred in a general way to course readings, but were not counted for this analysis.

Notes Which Contained Hints

The students in both the 1986 and 1987 courses were very helpful to one another in suggesting hints for using the system. In both courses, a specific Help conference was set up and was very active. In addition, approximately 15% of the general notes were directed toward suggestions on how to use specific features of the system.

STUDENT ACHIEVEMENT

Overall Course

In these small courses it is difficult to determine student learning and compare that learning with courses offered in other modes. The instructor's impression is that these students accomplished at least as much as graduate students in similar in class courses. The results in the 1986 course were very impressive. The students were able to integrate the course readings very well and apply their learning to actual case studies. The papers were well written and were carefully related to the material of the course. The grades were superior to those for similar courses offered in class. The instructor felt that in many ways the student performance was superior to similar courses. The students paid closer attention to course materials, had discussed the materials in more depth, and had clearly identified important issues and developed individual positions related to these issues. The second course is not yet complete, but the main conference has contained an in-depth discussion of several important course concepts.

Learning Partners

The joint papers in the second course seemed superior to the individual papers written on the same topic prepared for the first course. It seems that the necessity of discussing the topic in-depth with one's learning partner helped to identify important issues to a greater extent than writing alone. One of the difficulties with using small groups in a course is that one or more groups can not seem to deal with the interpersonal problems inherent in a small group and the group ends up letting one person do most of the work. Since, the instructor could view the complete transcripts of five of the seven learning partnerships, it was clear that both partner contributed substantially to the effort. The learning partnerships were judged as highly successful in the 1987 course.

Small Groups

As this paper is being written, the small groups have not yet finished their assignments. Thus, it is impossible to judge the achievement of the small groups. The drafts which have been prepared to date indicate that each of the small groups is likely to succeed. It is hard to tell if the equality of participation noted in the learning partnerships will continue in the small groups. There are more individuals to coordinate, and the situation seems to require more task leadership than the learning partnerships.

STUDENT REFLECTIONS ON EXPERIENCE

Overall Course

Student satisfaction was collected in a number of ways for both the 1986 and 1987 courses. Students in both courses were asked to respond to Likert scales on a number of issues. Satisfaction was high in both courses,-- with both the structure of the course and the interaction with the instructor.

At the end of the first course a discussion was conducted about the experience and a number of themes emerged. First, students commented quite positively on the convenience of computer conferencing. They commented on the convenience of being able to work at during times that were most appropriate to them and at times when they had energy or uninterrupted time to concentrate.

As one student said, when commenting on what she got out of the course,

> "I feel that I got an awful lot out of the course. I put a lot of time and effort in the course, but I could only do that because I have a computer sitting in my den that I (can) ... work on at my own speed and my own time. The other course that I took ... was so frustrating because I could never keep up with what was going on in class. I was always behind. Whereas with this one, I could catch up. ... or if I couldn't figure out this section I didn't have to say anything. Or if I couldn't figure out the article, I could see what other people were saying first."

Several students reported about the value of being able to access the computer at times when the course work did not conflict with other family responsibilities. Young children often need attention during the critical 5:00 pm to 8:00 pm period when most part-time courses are offered. With the computer conferencing system people could work during the day when children were elsewhere or work late at night or during the early morning. This convenience allowed the student to devote full attention to the academic work without being distracted by other family concerns.

The second major theme which emerged during the 1986 interviews was the strong relationship between the course and the required reading.

> Student: "I think for some of us who sit in a class and don't

> say anything, we haven't done the reading. You are not going to read very much in Community (the conference) before you realize that you have to do the reading. Even if you are not going to contribute, you still have to do the reading. I have never been in a course like that where there has been so much internal pressure to stay up. But this time there is a lot of motivation. You have somebody, a learning partner, or somebody else. If you are going to respond to somebody's note, you have to do the reading. I find that there is a lot of push."
>
> Instructor: "You are saying that that is good?"
>
> Student: "Oh yes."

Another student reported,

> "You can't help compare this course with others. What did accomplish in the others and what did I accomplish here? .... In this method it has been almost compulsory to do the reading. There is far more learning going on in this course than listening to the other chap week after week."

For one student the emphasis on the readings presented some problems.

> "In other words if you haven't read a particular article or skipped a week and went to Toronto or something and came back it was hard to get back into the groove and understand what they were talking about and you couldn't comment on it. What I'm trying to say is that its important in this course to keep up."

Responding to that comment, another student observed,

> "But I found that you could even get around that, because you could just make a note of the thing that you read that you didn't know what you were talking about and catch up and then read them all again. You know, it is not as if it were lost. You can always go back and start fresh."

The students also reported on the quality of the interaction in the course.

> "I think the experience was intense because of the computers. It wasn't once a week for a few hours and then leave it. I found it a big difference in that it was continuous."

Finally, the students commented on the feeling of community in the course. As one student said,

> "I think the fact that we were dedicated to development and being a community ourselves. I would look atthat as well and just see how we were operating. It was just like it was intensified for the whole thing. Not only were we doing it and learning it, but we were it."

Learning Partners

All but two of the students reported satisfaction with the learning partner exercise. They indicated that it was important to set explicit expectations for tasks and to set specific due dates for particular parts of the assignment. In the discussion of the exercise, the students felt that it was important to spend some time on the computer at the same time. As indicated in the analysis, a major strategy was to send drafts of the paper back and forth. One student would write a draft of a section and the second student would edit the work of the first, adding points and changing wording as appropriate. The draft was then sent back to the first student for another round. In the five active learning partnerships the mean number of drafts were six, ranging from a low of three drafts to a high of 10 full drafts.

Small Groups

At the time of writing, the small groups have not yet completed their assignment. However, all of the small groups are active as none of the groups are composed of members located in the same geographical location. The small groups seem to be using the same strategies as developed in the learning partnerships. The groups have set up schedules of tasks and given themselves due dates for each task. The groups have all developed drafts of the final paper and are currently commenting on and changing specific words and phrases. There has been a lot of discussion about approaches to the problem.

Learning Style

With the small number of students in the course it is, of course, not possible to analyze the outcomes by learning style. As a consequence, the learning style data are reported for descriptive purposes in this section.

Ten of the students had an Accommodator learning style, two students were Divergers, one student was an Assimilator, and one a Converger. Four of the seven partners had similar learning styles and two learning partnerships were composed on individuals with different learning styles. An inspection of first papers indicated no discernible differences in the papers of those learning partnerships with similar learning styles and those partnerships with different learning styles. Similarly, there seems to be little or no difference in rate of contribution or satisfaction with the course related to learning style. The computer conference mode seems to provide an experience that is at least acceptable to a variety of learning styles, although more research is needed in this area.

SUMMARY

Methods of Facilitation

This paper has explored two methods of facilitating learning in a computer conference. These two facilitation methods have emphasized the joint writing of assignments. The students have been successful in the assignments and have commented favourably on the experience. The students have developed successful strategies for writing together and emphasize the need for clear expectations of one another and careful planning of time. It is too early to tell the appropriate size of groups for this kind of assignment. One student who had taken another computer conferencing course with small groups commented favourably on the learning partnerships. She felt that early in the experience working with just one other student was not as confusing as trying to negotiate with several others. We will see at the end of the course whether starting with just one other student is helpful while learning the mechanisms of working with the computer conference.

Learning Style

Due to the limited number of students and the similarity of learning styles in the 1987 course not much can be said about the interaction of learning style and this mode of instruction. Students of all four learning styles seemed to participate equally in the conference and student achievement does not seem to be linked with learning style. This observation is impressionistic, however, and additional research with a much larger sample is needed to determine if there is an interaction between learning style and computer conferencing.

Future Research

At this stage we know very little about ways to facilitate learning through computer conferencing. This paper has explored two techniques using joint writing assignments and they seem to be successful. The data are impressionistic and we need to continue to experiment with different techniques. Future research could profitably focus on different size groups, different kinds of assignments, different presentation methods (i.e. presenting some material on-line), and the relationship of learning style to student achievement. It is hoped that this paper has presented some food for thought. As the computer conferencing medium is so new for distance education, there is a need for the sharing of experiences as we develop the medium.

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Integrating Computer Conferencing Into Distance Education Courses: A Discussion Paper

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ABSTRACT

This paper raises a number of questions about the use of computer-mediated communications in multi-media distance education courses aimed at large numbers of home-based students. Its objective is to stimulate discussion at the Symposium on the design of an appropriate architecture for electronic communication networks in distance education, and on the issues of media substitution and the integration of conferencing with other teaching and learning media. Reference is made to current plans for using CoSy on a new Open University course , and particular emphasis is placed on the expected role of the tutor in the conferencing situation. The paper concludes with a brief discussion of the implications of conferencing for the design of mass distance education courses, and for the underlying educational model on which such courses tend to be based.

Use of media in distance education

Distance education systems which provide instruction to large numbers of students spread over wide geographical areas, characteristically use a range of different media and teaching methods, each associated with particular learning goals[1]. For example, specially written print materials, designed to encourage active participation by the reader, and to allow a variety of reading strategies, are generally used to convey the principal academic content of a course. Television broadcasts may be used to demonstrate scientific experiments, to visualise dynamic processes, or to convey primary source materials of a visual nature, whereas live radio broadcasts often serve feedback and magazine functions. Contact with tutors and other students, at face-to-face meetings or over the telephone, is generally the occasion for discussing learning difficulties related to particular concepts in the course, for analysing homework assignments, or for carrying out group learning activities. Correspondence tuition provided by tutors to individual students is usually focussed on assignment work submitted for grading purposes. Other media traditionally used in the distance education context (eg audiocassettes, videocassettes, CAL software) each have their specific role to play in what is generally a carefully orchestrated educational composition.

A priori, it would appear that electronic mail and computer conferencing could play a major role in distance education systems, provided that technical and cost barriers are minimal (ie that learners and tutors have easy access to the necessary equipment, that telecom charges are kept down, and that the software is sufficiently user-friendly). Features of computer-mediated communication which seem particularly adapted to the distance education situation include:
- the overcoming of space, time, and access constraints to communication amongst students and tutors : any one user can conveniently find and contact any other users of the network, in a way which is virtually impossible using traditional communication methods

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[1] (for a recent analysis of the distance education at university level see Rumble and Harry, 1982; and Henri and Kaye, 1985)

- the convenience of a store and collect technology for message handling: texts can be sent and read at times chosen by each individual user
- the text-based nature of the medium (as opposed to voice or audio- visual communication), which is consonant with the skills of textual analysis and composition which are key features of the distance learner's repertoire
- the central storage of all text, so that messages or parts of messages can be retrieved at will at a later date, and used in a variety of ways (eg text can be down-loaded and edited into other documents, written comments from fellow-students or a tutor can be incorporated into an ongoing piece of work, the text of a conference can be subsequently edited to produce a report)
- the facility for group communication, which could be used for self-help activities amongst students, for co-operative learning, for on-line seminars, and for team-work in creation of project documents and assignments.

This paper raises questions about the ways in which the unique properties of computer- mediated communication might be exploited in multi-media distance education, with particular reference to trials currently being carried out at the Open University in Britain (Kaye, 1987). It explores the issues of media substitution (eg should electronic mail be used to replace telephone contact?), media integration (eg in what ways might the use of computer conferencing change the ways learners use print and audio-visual materials?), and, most importantly, choice of educational approach (can this technology make distance education a more humanistic process?). Although issues of an organisational nature are not explicitly discussed, they are raised where relevant. The introduction of a new technology into an existing system, especially a large-scale system, can be problematic: existing roles and job functions may need to be re-defined, and organisational structures modified.

At the moment, it seems neither wise nor possible to attempt to provide complete answers to the questions raised here. However, the presentations and discussions taking place at this Symposium will certainly be of great help in progressing towards eventual solutions.

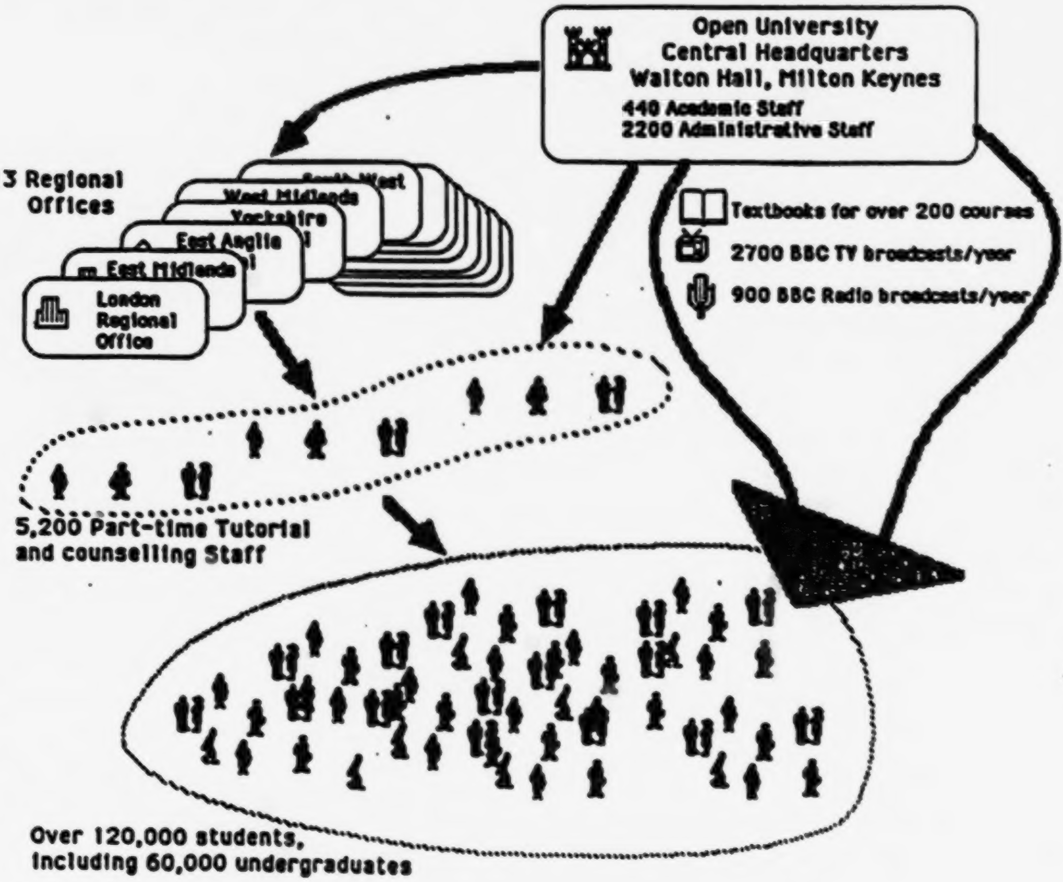
System architecture

What factors need to be taken into account in designing the "architecture" of an electronic , computer-mediated, communication system for distance learners? In dedicated distance teaching institutions such as Britain's Open University, or Athabasca University in this country (also planning to use conferencing in its teaching), this can be a complex issue. In such institutions, particularly for courses enrolling several hundreds or thousands of students each year, there is generally a clear separation of responsibilities for course development , on the one hand, and tutoring, on the other hand. Centrally based course development staff are responsible for designing and producing mediated courses, often on a full-time basis, whereas tutors may be recruited locally or regionally on a part-time basis to look after a specific group of students. They are responsible for helping students with , and grading, assignment work , and for providing personal contact and help at face-to-face meetings, or by post and telephone. On courses in our institution, each tutor is responsible for 20-25 students, and is the only direct personal contact that a student has with the University teaching staff . However, the tutors are not full-time staff members: they generally hold their principal appointments at other universities and colleges . When working for the OU, they are acting as intermediaries for teaching prepared by our central course development staff. The latter may occasionally act as tutors on their own courses, but on any large-scale course, they would form a tiny minority of all tutors. In the British OU, the organisation of tutorial provision , and its articulation with central course development, production, and distribution activities, has led to a complex and hierarchically organised communication structure (*see Figure 1*). The locus of responsibility for organising tutorial provision, for setting up and running local study centres, and for allocating tutors to courses and to student groups, lies in the 13 Regional Offices. Like the students, the tutors receive their course materials from the central campus .

It is not clear how best to insert a computer-mediated communication system into such a structure. Should existing communication flows - and only those - be maintained? If so, then the full potential of an electronic network will not be realised. It would mean, effectively, restricting conferencing and electronic mail communications to within the existing, hermetically sealed, student/tutor groups. In an OU course with 1,000 students, for example, there would be at 40 - 50 such groups, each with one tutor. Normally, teaching/learning communications between students and tutors are restricted to those which occur in these groups, apart from very occasional opportunities for wider contacts at residential or day schools.

An electronic conferencing and mail system (we now have CoSy installed on our central computers) *could* , however, open up completely new communications horizons for students, tutors, and course development staff. In addition to facilitating and multiplying contacts within each tutor group, such a system has the potential to allow for:
- any student to contact any other student on the course, and set up conferences, private or public, which anyone on the system could join
- pairs or groups of students to work together and create assignments, reports, and term papers jointly, using the cooperative document preparation facility available on the conferencing software (eg the "workfile" area on CoSy)
- individual students to contact other tutors than their own, and thus , potentially, compare one tutor's views and advice with another's
- students to have direct access to any of the faculty course development staff with id's on the system, and therefore very easily send them electronic mail messages with questions and comments about their teaching materials

Figure 1: Communication Flows in the Open University
(courtesy of Gary Alexander, Faculty of Technology, Open University)


Open University
Central Headquarters
Walton Hall, Milton Keynes
440 Academic Staff
2200 Administrative Staff
13 Regional Offices
South West
West Midlands
Yorkshire
East Anglia
East Midlands
London Regional Office
Textbooks for over 200 courses
2700 BBC TV broadcasts/year
900 BBC Radio broadcasts/year
5,200 Part-time Tutorial and counselling Staff
Over 120,000 students, including 60,000 undergraduates

- tutors to have ready and ongoing access to each other, and thus be able to compare notes on tuition and grading practices
- course development staff to put up notices in "news" conferences, which could be used not only for stop press and magazine items, but also for up-dates and revisions to printed course materials.

It is not clear to us whether we should deliberately design an architecture for the electronic communications system on the courses which will soon be using CoSy, to include some or all of the above functions, or whether we should wait and see what our users (students, tutors, and faculty) actually do if we impose no constraints . The analogy would be with the routing of footpaths between the various buildings on a new campus: is it better to plan and lay these down in advance, or to wait a year, and see which routes people want to take before laying the paving slabs? One thing is for sure: this technology, if adopted by students and tutors, will inevitably lead to significant changes in the existing communications flows in our teaching system. And these changes may well call into question many of the premises on which that system was designed.

Media Substitution

"Based upon our experiences and research with computer conferencing, we believe that one important requirement for realising the promise of new educational technologies is to use them to create learning and teaching environments that are more effective and exciting for at least some kinds of materials, rather than merely trying to to replicate the traditional classroom electronically." (Hiltz, 1986)

The same argument can be applied to the distance education context - it probably does not make sense to use conferencing to replicate the traditional distance education situation electronically. Conferencing is *par excellence* about interaction, so one needs first to look at the interactive media normally available to distance learners. Most distance education systems have three principal media or channels of interactive communication linking students, tutors, and counsellors: correspondence tuition, telephone contact, and face-to-face meetings. To these one can add, in some countries (eg here in Canada) phone-in links to broadcast radio and TV programmes, as well as two-way radio and facsimile transmission of written documents. The ways these media of communication are used - singly and in combination - vary from one distance teaching situation to another, but group tutorial meetings, correspondence tuition, and telephone contact remain the three principal forms (Abrioux, 1985). To what extent, if at all, might computer-mediated communication supplant some of these channels of contact?

Again, this seems a difficult question to answer at present. Certainly, on one particular course, we are recommending that a significant proportion of the time normally set aside for face-to-face tutorial meetings should be used for computer conference discussions. So instead of meeting for a couple of hours once a fortnight at a local Study Centre, tutor and students would have, say , only two or three face-to-face meetings throughout the year , the remaining contact time being spent in on-line communication. However, there is some evidence to suggest that the introduction of computer conferencing into dispersed communities of users may lead to an increase in other forms of communication amongst some of those involved (see for example, Kerr and Hiltz, 1982). Maybe the increased level of contact which conferencing would permit in our situation might lead to an increased demand for face-to-face contact, and it would not be appropriate to imagine conferencing as being a substitute either for face-to-face meetings, or for postal contact and telephone calls.

One *might* suppose that electronic mail would be likely to replace written communication between tutors and students - after all, it can be more convenient, is much more rapid, and is not necessarily any more expensive. However, in our system, the main function of written correspondence tuition is for tutors to evaluate, annotate, and grade written work submitted by students. There are good reasons, both administrative and pedagogical, for keeping these communications paper-based. The central assignment handling system, which copes with over 500,000 tutor-marked assignments each year, has been designed on the basis of written evidence of students' work and tutors' evaluations , although all grades are eventually transferred onto computer files in the student records system. To set up, in parallell, a totally electronic submission system for those few courses which use micro-computers and comms facilities, would not make sense administratively. Looking at the pedagogical issues, one can also see advantages to using paper: students receive back their work with the tutor's comments and annotations against the relevant parts of the text. Were assignments to be submitted electronically, current software would require the student's text (eg an essay) to be sliced into a series of discrete messages, so that the tutor could make message-based comments via the conferencing system[2]. Furthermore, assignment work in many disciplines requires students to produce sketches, graphs, and other diagrams , and , once again, current conferencing and email systems cannot cater for these functions adequately, just as they cannot cater elegantly for written comments.

It is conceivable that electronic mail and conferencing will replace a certain proportion of the telephone communications that take place between tutors and students. At the moment many of these calls concern difficulties that individual students experience with specific parts of the course material, or with particular assignment questions. Obviously, if students , instead of making individual phone calls, send their queries into a group conference space, it will mean that the tutor will not have to deal with the same problem with each student separately, and that other students will be able to contribute their own explanations and views. The mere psychological factor, for a student, of realising that others in the group are having similar problems, and that they are not alone in experiencing difficulties, can be very motivating. And the asynchronous nature of computer communication has certain clear advantages over voice telephone calls , when there is always the possibility that the person called will be unavailable, or preoccupied with other matters. On the other hand , there is no doubt that electronic mail/conferencing is not a substitute for certain properties of voice telephone communication -especially the intimacy, and the spontaneity of response that telephoning permits. In a recent report of trials of electronic mail and facsimile transmission in a distance teaching project for schoolchildren in Australia, for example, mention is made of the psychological importance attached by children and parents to voice telephone contacts with correspondence tutors, even though the ostensible purpose of these calls was to alert parents to switch on the fax machine at home for the imminent transmission of the tutor's written comments on a child's homework (Vivian, 1986). The telephone conversation provided the opportunity for an informal chat, as well a chance to clear up difficulties experienced in using the new technology. It is quite possible that, in our situation, the introduction of conferencing and electronic mail will lead to an increase in telephone contacts between and amongst students and tutors, particularly at the beginning of the course, when people are learning how to use the system.

We have certainly noticed this phenomenom amongst new faculty and regional staff users: beginner's unfamiliarity with this new medium of communication seems to be associated with a need to use a more traditional medium (the telephone) to check whether a message has been received, to talk about the message, to apologise for mistakes in its formatting, or simply to receive reassurance.

So the question remains open as to whether computer communciation will *replace* existing forms of communication in our system, or develop as an additional medium in its own right. Despite the relatively primitive nature of current systems , this is a medium which is qualitatively different from the other interactive media used in distance education. Electronic mail is not the same thing as written mail: messages can be sent and received instantaneously, searched and filed by a range of parameters, edited into word-processed documents, and generally manipulated in ways that would be impossible, or extremely time-consuming, with handwritten or typed mail. Conferencing software, in addition to providing chances for group communication at times where previously none might have existed, also permits forms of communication that are quite different from face-to-face meetings, or audio or video conferences. Many of the cues that regulate communication in the latter situations (body language, eye movements, intonation, accents etc) are missing. Comments are made when it suits the participants , allowing time for reflection, and have to be evaluated on their objective content and meaning alone. Conference systems can provide for serendipity - queries sent to a conference might provoke responses from people one did not know existed: informal networks and interest groups can spring up overnight in ways that would be impossible using other communication channels. Above all, in the distance higher education context, where so much of students' learning activities are concerned with reading, understanding, and creating text materials , the fact that computer-mediated communication is text-based takes on major significance. The discipline of having to formulate one's thoughts carefully in writing, and submit them to public scrutiny and comment by fellow-students and teachers, begins to make computer conferencing a new distance learning medium in its own right. However, for this new medium to reach its full potential, further progress needs to be made in the use of centralised conferencing facilities in conjunction with micro-computers running word-processing, graphics, and communication software. Systems currently under development , including general application " third generation conferring systems" (Hart, 1987), as well as those specifically designed for the distance learner (Alexander, 1986), or for a "virtual classroom" (Hiltz, 1987) will hopefully take us towards the goal of a communicating writing and graphics tool tailor-made for educational use.

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[2] This is a relatively cumbersome procedure, as experience of using CoSy to submit and comment on a series of articles for a recent issue of the *Canadian Journal of Educational Communications* has demonstrated to some of us here.

Integration : an example

Appropriate use of computer-mediated communication in distance education, then, is not simply a matter of substituting electronic text communication for other interactive media. Rathermore, what is needed is a complete re-think of overall course design, to accomodate the use of communicating micro-computers by students in their learning activities. This in turn raises questions about how we integrate conferencing and electronic mail with the other media at our disposal. The issue is complicated by the fact that the relevant technology is currently a moving target, and that there are other applications of new information technologies to distance education which will need to be considered at the same time (eg on-demand printing, CD-ROM, broad band teleconferencing links etc). Theoretically, it makes little sense to aggregate these developments in a piecemeal fashion onto an already complex system, itself designed in the late 1960's and built predominantly on a print plus broadcast model of distance education.

On the other hand, it would be foolish to sit back and wait until an ideal system is available, and , in any case, the ideal system is unlikely to appear without experimentation and the development of successive approximations to some ultimate goal. As one step in this direction, we are currently working on ways of integrating conferencing and electronic mail into a major new course (*An Introduction to Information Technology*) which will be starting next year, but within a certain number of constraints which imply that we may not be able to exploit the full potential of the medium:

- the basic design of the course is fairly standard (for the OU) , and includes specially prepared print and broadcast materials which will remain essentially unchanged for around five years, a normal tutor:student ratio of 1:25, with around 20 hours of contact time throughout the year, a series of tutor-marked assignments, and an end-of-course examination
- the course differs from other OU courses, in that each student and tutor will be using an MS DOS micro-computer, together with a printer and modem, for a number of practical work and communications activities (they will be learning how to use local word-processing, spreadsheet, and data-base software, as well as how to access remote data-bases and bulletin boards, and they will be using CoSy for some of the course work)
- as for all OU undergraduate courses, the basic course design assumes that students will spend around 10-15 hours per week in total on course work , but the portion of this time that we are notionally allocating to on-line activities does not exceed one hour per week for each student and

tutor , once students have learnt to use the conferencing software[3]

- students will not be able to submit their assignment work electronically , but they will be able to discuss their ideas or drafts via CoSy , with the tutor or with other students, before sending in the final texts on paper
- the eventual course quota is about 2,500 students each year, and in 1988 we will probably be starting with about 1,000; this means that it is not possible to carry out any trials with small groups of students beforehand.

The problem of the integration of computer communication into this course is thus twofold:
(1) how best to integrate the notional one hour per week of on-line time with the other activities (reading, practical work, writing, watching broadcasts etc) on which students will be spending around 12 hours each week
(2) how best to exploit the unique properties of the medium, rather than using it as a mere substitute for other channels of communication.

In trying to address this problem, we will be advising students and tutors to concentrate their on-line activities on group discussion of the principal themes covered in the print, broadcast, and practical work components of each part of the course. The emphasis on *group discussion* within each tutor group conference space, as opposed to use of the personal mail facility, is the vehicle for exploiting the unique properties of the medium, and the opportunity to *talk about* the information and concepts presented in the other components of the course will provide the principal channel for integration between the different media used.

However, if these group discussions are to become rewarding and useful learning experiences for the students, they will need a definite focus, some structure, and specific goals. How might these elements be provided? To answer this question, it is necessary to say a few words about the course itself, which is an inter-disciplinary second level undergraduate course, with contributions from social scientists, technologists, and educationists. The course approaches the subject of information technology from a variety of different perspectives, and through analysis of several application areas (the home, the workplace, banking and finance, government, education , manufacturing etc). However, there are a number of common themes - both social and technological - which run through the entire course. A major proportion of the work that students will be asked to do for their assignments is concerned with an analysis of these principal course themes, and students will be expected to draw on both social science and technology concepts in writing answers to the assignment questions. One major use of the conferencing facility could be prior discussion of these themes , in the light of the specific assignment questions, before students draft their individual answers. This would provide a definite focus and motivation for the tutor group conferences, and would also be the occasion for students and tutors to synthesise and integrate, through discussion, the principal concepts taught in the course. Potentially, this could become a very powerful learning tool.

Another focussed use of conferencing in the course would be for development and discussion of ideas for the student project. Each student will be required to produce, by the end of the course, a report on a specific aspect of the use of computer-mediated communciations in education or training. Individual students will be free to choose a specific angle for their report, and will be encouraged to use the course-wide conferencing and messaging facility to poll other students on their views, and to obtain specific items of information (eg personal access to new information technologies, impacts on family life and working habits etc).

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[3] Based on the findings reported by Hiltz(1986) and Harasim (1986), we are assuming that 3 - 5 hours will suffice for users to learn to feel comfortable with using the conferencing software.

We will be encouraging students on the course who want to (and who are prepared to commit the additional time and connect charges), to set up and moderate their own conferences on subjects which interest them, and these might provide a further focus for integrative learning experiences amongst students. We also plan to set up at least two course-wide conferences for socialising and recreational purposes, along the lines of the "student lounge" (students only) and the "cafe"(students, faculty, and guests) available in the Connected Education project[4] on EIES .

Conferencing could provide a valuable medium for helping tutors in their work, and we hope to experiment with one or two applications which could promote integration within the course. On a conventional OU undergraduate course, tutors rarely have the chance to meet and discuss the course content and their approach to running tutorials and evaluating students' work, other than at briefing and de-briefing meetings held at the beginning and end of the course. And yet individual tutors, as their experience of a course builds up from year to year, are an invaluable source of advice and information, not only on tuition, but on ways in which the different components of a course can be integrated. On the *Introduction to Information Technology* course, we plan to set up a closed and unlisted conference for tutors ("A Senior Common Room"?) which will provide a space for discussion of effective tuition practices, as well as for tutors to help each other with problematic aspects of the course. We are expecting that many of the tutors will be either social scientists or technologists, and may need support in dealing with queries on the discipline area which is not their own. Through CoSy, we can , for example, twin each Social Science tutor with a Technology colleague, and also provide a forum for group discussion on the more difficult or specialised course concepts.

We agree with Andrew Feenberg that *"..... purely expository materials are..best distributed to participants on paper to serve as part of the context of a conference, .."* (Feenberg, 1986) . With the exception of a notice-board type conference , which will be used for stop-press items and occasional up-dates, we are not planning to use computer communication on this course for presenting information - this function is performed far more adequately by the print , broadcast, and cassette materials . The only possible exception to this rule is the idea of putting a central and regularly up-dated bibliographic data-base at the disposal of students and tutors. In the Institute of Educational Technology, for our own research purposes and for external users, we are currently preparing two on-line bibliographic data-bases, one on distance education , and one on educational applications of computer-mediated communications. And for the *Introduction to Information Technology* course, we have developed an extensive bibliography which, likewise, could be put on-line. It is possible that we might make one or more of these data-bases available to students and tutors on the course. Apart from these potential applications, the principal thrust of computer communications is intended to be group discussion of major course themes and of students' assignment and project work, within the fifty or more individual tutor group conferences which will be running once the course starts up.

Conferencing as a subversive activity?

The example of our first major course to use conferencing has been developed at some length above as an illustration of the current state of our thinking concerning ways of integrating this new technology into the traditional distance education model of course design. It shows our starting position, but only begins to indicate where we might finish were we to take some of the implications of using computer communications to their logical conclusions.

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[4] Set up by Paul Levinson, in conjunction with the New School for Social Research in Manhatten, and providing on-line courses as part of an MA Program in Media Studies.

Bertrand (1979) classifies models of education - on which we implicitly or explicitly base our behaviours as teachers and learners - into three broad categories: institution-centred models, person-centred models, and society-centred models. A distance education system such as the Open University is essentially an example of an institution-centred model, with its stress on maximising the effectiveness and efficiency of educational practice through the careful and pre-planned structuring, processing, and transmission of information.

And maybe it tends to attract students who feel comfortable with the premises of this educational model. Computer conferencing, on the other hand, is a technology which will perhaps reveal its greatest potential within the framework of a person-centred model - with an emphasis on growth, on learner motivation, and on active negotiation and construction of new and personally meaningful knowledge within a non-threatening group situation. Computer conferencing practitioners generally note factors such as .."*the non-dominative, or liberative discourse* " which this technology permits (Boyd, 1987), the fact the..." *the electronic environment is a more democratic space (than the classroom)*" (Harasim, 1986), or the importance of the moderator's role in "*.. encouraging personal viewpoints and diversity of opinion rather than..offering authoritative solutions to the problems posed in the course*" (Feenberg, 1986).

In the traditional distance education context, the use of computer-mediated communications by students and tutors could have far-reaching implications on a number of counts. Firstly, as the quotations above imply, it provides a democratic, relatively status-free, environment for group interaction and learning. This not only provides students and tutors with ready communication channels to course development staff, but also provides an environment for peer teaching, and a chance for students who may know more about certain aspects of the course than the tutors or faculty members, to demonstrate this knowledge publicly. On the other hand, it also provides opportunities for students who have wrong or misconceived notions about the subject-matter of a course to propagate these notions at the flick of a switch, and thus mislead others in the group, and create difficult situations for the tutor and the group as a whole to disentangle.

Secondly, conferencing opens the door to unplanned events and interactions within systems where a great deal of time, money, and human resource is invested by course development teams in planning, structuring, and packaging mediated course materials, and "optimal" learning sequences. Informal communication networks can develop amongst students and other users, successful conferences thrive on suspense and surprise (Feenberg, 1986), and the unexpected can become the order of the day. What are the implications of these factors for course design?

Thirdly, any significant use of computer conferencing (as opposed to other on-line applications such as data-base access) could radically change the cost structure of distance education as it is practised by institutions such as the Open University. Up to now, such systems have relied on amortizing investment in high front-end course development costs by enrolling very large numbers of students, and keeping student-related costs to a much lower level than in conventional institutions (Rumble, 1986). Conferencing is likely to require more inputs, and more time , from tutors than the traditional distance education situation, especially during any transition period from paper-based correspondence tuition to a complete electronic tutoring environment.

These factors take on a particular significance when considered against the role of distance edcuation institutions in providing mass higher education. Will it be possible to reconcile the use of conferencing with the features of mass distance education courses, or are the effective applications more likely to develop in the context of low population post-graduate and specialist courses for professionals, of the sort reported by Davie and Palmer (1985) , where it is possible and sensible to base the course on group learning and a person-centred educational model ?

Maybe we will have some answers to these questions by the time the third Guelph seminar on computer conferencing takes place!

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Computer Conferencing: Its Contribution to Self-Directed Learning

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ABSTRACT

The concept of group learning through discussion has finally come of age in post-secondary education circles. At the same time, computer conferencing, a unique tool for facilitating this action has become available to educators. Using conferencing, like other interactive methods, requires a change in students' attitude to learning.

Significant cracks are appearing in the model of education where 'the teacher who knows tells the student who doesn't'. The literature on student learning reflects a growing realization that students' ability to learn from each other has been sadly underestimated, especially at the undergraduate level. Books like Learning in Groups and Teach Thinking by Discussion are brim full of ideas for introducing active learning into the university curriculum. A whole new jargon abounds with concepts such as 'buzz groups', 'cooperative scholarship', and the 'Atlas Complex' which describes the state of mind that keeps teachers fixed in the centre of their classroom, supporting the entire burden of responsibility for the course on their shoulders. Teachers as well as researchers are coming to see that students cannot assimilate knowledge without making it personally meaningful, without connecting it to existing forms of thought.

> "Learning is not simply moving from ignorance to knowledge. It is giving up one conception of something for another way of conceiving it."(1)

However, as we at the Open University and many others have discovered, attempts to devolve the teacher from stage centre and hand over responsibility for learning to the student are not met with cheers and grateful thanks. In most cases far from it! Students have for years been conditioned by teachers, by the system, by the educational milieu to accept the role of passive, dependent, competitive learner. Student resistance to taking an active part, in directing their own learning appears to come in two forms:

i) feelings of anxiety, lack of confidence

ii) realization that it requires more work

As part of the Student Learning Group at the Open University, we conducted a number of depth interviews of students taking our Third World Studies course, a second level interdisciplinary course covering the economics, history and literature of the Third World. The team of lecturers and consultants who wrote the course had, as part of their teaching strategy, the aim of giving students the opportunity to engage in a greater degree of self-directed learning than is the norm on our undergraduate courses. Firstly, the amount of material sent out students -- text, readings, a specially prepared atlas, a number of case studies etc. was in excess of the usual amount of study material. Students were advised to skim through the material and select areas for in-depth study, following one strand, whether literary, economic or sociological, through the various countries presented. Secondly, two of the usual essay assignments were replaced by an extended project. Suggestions were made about possible topics, but students were expected to devise their own work in consultation with their tutor.

Fourteen students were selected at random from a range of educational backgrounds to be interviewed in their homes, about their reactions to this teaching strategy and their views about learning. Quite unexpected was the response from both the A students, aiming for honours and C students just hoping for a pass. For example:

Q. As you know there is the suggestion that you choose parts of the course to study in depth...

A. Well yes, but in a funny way you are pushed into not accepting that really.

Q. Why is that?

A. Well I suppose it is all there and you feel it's all got to be done...no, I'll rephrase that, perhaps you want to do it. I find it difficult to think of it in those terms.

Q. How do you mean?

A. Well I just can't feel I want to leave things out.

Q. Even though they have more or less suggested that?

A. Yes, I feel almost guilty if I did, leaving aside my present problem of being way behind.

Q. Well given your present problem, do you still not feel you can leave chunks out?

A. Well I will have to, but I will feel guilty. I feel somehow that I have missed out. Maybe it's the old work ethic. I feel somehow I have failed.

And from a different angle:

Q. Are you implying that the course team has told you to be selective and yet in a way they aren't allowing you to be?

A. Yes, there is something in that. I do feel it's their course and think perhaps I'm not understanding it as it should be. The guidance isn't tight enough. They should tell you what to select. They say it's OK to be selective, you don't need to study everything, but because the student may not be familiar with the course, he doesn't know how.

These verbatim quotes show just how deeply ingrained the traditional model of education can be. They also point to the naivety in thinking that independence can be given to students. It can certainly be taken away from students but likewise, it must be taken back by them.

In addition to the feelings of anxiety and lack of confidence about having to make their own path through the material, students also expressed real excitment with the content and presentation of the course. Clearly many were attracted to the model of making one's own personalised course rather than digesting whole that of someone else.

Experimental Learning Groups

There are many more carefully devised schemes to encourage student initiative. One of these is an experiment by the Co-operative Learning Project at the University of the District of Columbia in group learning. In this case, lectures and teacher-led discussion were eliminated in favour of group activity on a plan devised by the instructor. The results were that students and teachers consistently favoured group learning in terms of its effectiveness, its skill development, and its enjoyment. Strangely however, fewer than expected numbers opted to take further courses using this method, and the evaluators have concluded this was because students were reluctant to put forth so much effort in all their classes!

> "It is hard for students to give up the notion that knowledge can somehow be 'given' to them" (2.)

Another experiment, devised by K.G. Collier at Temple University, involved a different aspect of the potential of the group: joint presentations and cooperative preparation of material for assessment. Called the Syndicate Method, it divided a normal university class into small groups of five or six students for the purpose of discussing assigned readings and preparing a joint presentation, either oral or written, to the whole class. These were followed up by the lecturer summarizing and extending the arguments. The final evaluation of the project showed a real move towards greater intellectual independence by students, as well as the admission that they worked much harder with this method:

> "The method in this course actually teaches. The emphasis upon individual efforts and discovery was new to me in the College classroom. Before, I and my classmates were lectured to (or at) and told to memorize the few sections of a book. In effect, we are used to having knowledge pass from the lecturer's notebook to the student's notebook without going through the mind of either. Fortunately, the organization of this course provided for discussion and lectures of summation and guidance." (3)

Learning Groups in Distance Education

In the field of distance education, the opportunities for learning through discussion, either with lecturers or with peers, is limited and the traditional patterns of passivity and dependence are reinforced. Although in the Open University we suggest to students that they might set up self-help groups, these are not given positive support by tutors and many students express their reservations about them in terms of 'the blind leading the blind'. This confirms conclusions reached elsewhere that there are two major elements to the effective use of learning groups:

active participation by students in the discussion

faculty expertise and guidance provided through structured tasks (4)

Learning Groups and Computer Conferencing

Converging on the university learning environment at the same time as these new directions* in teaching is the exciting world of computer-mediated communication. Exponents of computer conferencing wax eloquently on the very values which lecturers are slowly awakening to: free-flowing discussion amongst peers facilitated by the tutor, cooperative presentations and project work, and a strong emphasis on learning through expressing one's thoughts and refining them on the basis of feedback and related opinons. Claims are made that conferencing is for some purposes actually preferable to other forms of teaching. (5.) This is due to its status-free, content-focusing nature and to its emphasis on student participation. As the exploitation of conferencing is in its infancy in the education world, the language used to write about it inevitably relies more on potential than actual, more on what could be than on what has been. However, it is to be expected that the successful applications of conferencing in university teaching will be, initially at least,in distance education and/or at the graduate level.

If we relate this introduction of computer conferencing to the introduction of group learning and discussion techniques, we see that they make similar demands on students.

They both encourage greater independence and self-reliance as learners.
They both demand personal expression of opinions and critical abilities.
They both break away from the model of knowledge as chunks of information passed from teacher to student.
They both foster cooperation rather than competition between students.

* There is, of course, nothing new about the concepts of self-directed learning, of group learning or of learning through discussion. The literature on student learning, educational psychology, epistemology and communication has been littered with these ideas for many years. However, there is evidence now of a groundswell action to bring them out of the research papers into the lecture halls.

With so many fundamental similarities, we should suspect similar student reactions: enthusiasm and positive endorsement, mixed with lack of confidence and anxiety about becoming independent, tinged with the realization that it takes more effort to think for oneself! Graduate students are self-selected to some extent as confident in their learning ability and distance students generally have strong motivation, so these two target users of conferencing are an obvious choice for the introduction of conferencing.

Cautionary Tales

Just as lecturers have looked in vain for stimulating questions and discussion after delivering a lengthy lecture, so we will look in vain for full participation in conferencing simply by providing students with the technology. As has been experienced on many experiments already, the gear just gathers dust, or the user lurks but never becomes really active.

Our short experience at the Open University has led us to the following conclusions:

1. Students need to be coerced into using the medium. To put it more politely, the use of conferencing must be integral to the course and related directly to assessment.

In one experiment we conducted with tutors, we provided them all with an electonic mail facility to contact us at the centre and each other spread over the country. However as tutors in our system rarely have an opportunity to communicate with each other, there were no established channels, no tradition or model to translate into the electronic medium. Despite the fact that tutors have much in common--problems with students, with marking assignments, with presenting tutorials, the facility went largely unused. At the debriefing meeting at the end of the year tutors expressed positive interest in the medium but urged us to make it compulsory. "Put stuff on-line that we can't get any other way, then we'll use it".

2. The conferencing facility must be easy to use.

One of the reasons why we could not coerce tutors to use the system last year was that our hardware simply was not reliable and the software was not friendly. In order to justify making conferencing compulsory on a large (1000 - 2000 students) undergraduate course going out next year, we have developed a 'front end ' to CoSy. This provides automated log on, a simple menu- based environment, and 'hand-held' tutorials on how to send messages and make comments . In fact, students will only experience 'naked CoSy' if they wish to pursue an optional interest in the conferencing system., by entering the university CoSy environment.

3. It takes time for people to adapt to new directions in education.

General expectations about the role of teachers and learners plays an unconscious part in the minds of everyone involved in education. It will take time for students to adapt to the new climate of opinion about learning. A total reversal of the accepted norms of university teaching simply cannot work.

> "Students whose entire educational experience has been in traditional classrooms do not do well when suddenly left to their own resources in self-led groups...As students groups learn to function effectively, they are given progressively more autonomy. The goal is for groups to acquire the ability to develop their own learning plans, using the teacher as a resource and consultant" (6.)

Not only do students need time to adapt to new roles, but administrators need time to adjust their bureaucracy to handle the novelty of joint assessments and electronic submission of essays. We ran up against a brick wall on both these issues when trying to intoduce them at the Open University. However, as lecturers request them and students respond, so administrators will finally accept them.

4. Higher level uses of conferencing will need more attention

Just as it follows that having the technology doesn't mean it will be used, so too, using the technology doesn't mean it is being well used. In other words, communicating isn't necessarily educational. In fact, much of what one reads on actual conferences falls far short of real intellectual exchange. The phenomenon of 'overload' is not so much a problem of too many good ideas as of too much rubbish!

The conferencing facility at the Open University, although available for nearly a year now, has not really experienced 'lift off'. The feature of conferencing which is one of its greatest assets is in this context also a detriment: asyncronicity. In face to face encounters, one's thought processes are often disturbed by anxieties like having to break into the conversation, and whilst expounding, of being cut in on by another speaker. In conferencing, these fears are banished, but gone too is the focus that physical presence in one place gives. Unless users log in frequently and regularly respond to the drift of the 'conversation', there is no possibility of maintaining the thinking current in themselves or in the larger mind of the conference. Where courses are delivered entirely on-line this problem is much less likely to occur. But where conferencing is an extra 'goody' for students or university staff to experience, the higher level uses of conferencing are much more difficult to sustain.

Assessment

The question of assessment and its effects on teaching strategy is rather too large for the scope of this paper, however certain contradictions must be noted. We have concluded that conference participation must be made mandatory by linking it with assessment. This can be done in various ways: by assigning some percentage of the final grade to the quality of contributions to conferencing, just as is sometimes the case now for tutorial participation, or by putting vital information on-line which is not available in any other form. On our new course about Information Technology, we are devising a project around an on-line questionnaire. Students must answer the questions and upload them to a central data bank before they can access all the data to complete their project. Qualitative data, ie. open ended responses will have to be gathered on a special CoSy conference.

However, these coercive methods which may be very effective in getting students on-line, seem at odds with the next stage which is to establish conditions for on-line learning: a willingness to take risks, to accept correction and to respond to others critically. A number of the experiments in group learning referred to earlier have recognized this dilemma by abandoning assessment (i.e. assigning everyone a pass automatically), in order to encourage free and frank participation in student-centred tutorials. This dilemma has been avoided in many conferencing courses by directing the facility at post-graduates or at other non-assessed areas of education. However, once conferencing enters the undergraduate domain, this problem of initiating widespread use but encouraging 'good' use will not go away. One of the most positive factors in facing this difficulty is the number of conferencing exponents who are actively promoting this new direction in teaching and learning. (7.) The potential of conferencing as the unique medium for facilitating discussion has been recognized and is being nurtured as a new contribution to self-directed learning.

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Computer Alliances for International Faculty Development

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ABSTRACT

This paper will deal with the potential impact of computerized conferencing as an option for faculty development between dispersed nations. Among the topics considered are the ways in which the talents of the dispersed areas can be meshed with those of developed countries to the end of producing more informed and engaged educators. Topics to be covered include an overview of computerized conferencing for educational purposes; professional development; faculty recruitment and retention; and finally a consideration of the political implications for both intra- and cross-national educational communication.

Many institutions of higher learning concerned with maintaining the current skills and developing new talents of faculty will sometimes find themselves thwarted because of financial constraints which limit their ability to have faculty members travel to meet with their counterparts elsewhere. A mechanism such as computerized conferencing provides a framework within which continued interaction can occur while still maintaining the continued presence of faculty within the classroom. More critical than the simple interchange between individuals is the building up of a network of peers transcending national boundaries. Computer conferencing permits developing countries economically to sustain and enrich the competence of its existing faculty. In addition present obstacles to faculty recruitment and retention can be offset byu facilitating professional interaction with distance colleagues.

INTRODUCTION

> Today we live in an information society. Information has significantly altered our lives and has elevated our national well being to a higher plateau. However, if we are to continue to progress our nation will have to produce more high quality scientists and knowledge workers and many more technologically literate citizens. While the nation's needs for increased quantity and quality are pressing, so is the need for increased human capacity. If we are to progress, we must invest greater efforts into the development of new intellectual technologies in order to amplify man's learning, analytical, and problem solving power. Fortunately breakthroughs in computer communication technologies have created new opportunities for the development of human amplifiers.(Molnar,1982)

Although this view was expressed by an American it is reasonable to support that similar views would exist in many other countries. The communication forms which are conducive to human interaction and which are computer-mediated are genuinely active in the sense that they develop powerful new systems of interaction. Working groups create resonances and synergy through exposure to network interactions. What becomes transmitted is more "know how" than archival materials.

> Although it is new and may even seem somewhat futuristic in some of its capabilities, this kind of system is in fact a genuinely contemporary solution. Although sophisticated in appearance, it proves very simple to use, requiring only a short period of training and is designed to be used by non-computer specialists (OECD, 1983).

For those institutions concerned with installing dispersed learning programs, computerized conferencing makes possible multi-campus sections, special structures, electronic learning and continuing education at the work place. It may be instructive to comment on some of the economic advantages of computerized conferencing. In addition to reduced turn-around time, there is more certainty of text content, reduced cost of communication and above all electronic transferability. Costs can also be traded off with other communication media and alternatives.

Clearly the lack of effective communication systems is an impediment to industrial collaboration, research cooperation and resource sharing in many countries of the third world. The process of building a traditional communication infrastructure is slow and expensive. The on-line conference run by the international Development Resource Centre in Canada has pointed to the need to enable scientists within a developing country to communicate with each other and their colleagues in other countries, both industrialized and developing (IDRC Report, 1981).

OVERVIEW OF COMPUTER CONFERENCING

Description of the Electronic Information Exchange System

The EIES system has been thoroughly tested and it has been demonstrated that inexperienced users with limited understanding of computer technology can become proficient in about a week. Computerized conferencing provides a cost effective way of providing for interaction between affected parties.

The EIES system becomes a medium to link geographically dispersed groups of participants to evaluated various programs. Additional advantages of EIES in carrying out projects are the following factors: permits participants to interact at times of their choice; provides for continued interaction between participants; provides a written record of interactions which may be edited and reviewed numerous times as necessary; system can be used at a rate which is roughly one-quarter of the cost of a long distance all; the original information can be retrieved from the system at any time.

EIES is not a conventional computer system but rather a communication system which has been designed to be maximally user responsive. EIES has provided over 300,000 hours of services to users all over the continental United States, Hawaii, Alaska, Canada and Europe or wherever computer terminal which functions like an ordinary electric typewriter which has an acoustic coupler allowing it to be connected by any telephone to the system.

Through computerized conferencing, the potential exists for participants world wide to engage in many on-line conferences simultaneously as well as to maintain informal liaison with colleagues, similar to conversations over lunch. Not only can participants enter conferences from any location but they can still attend to all on-site local responsibilities. Thus the power of the individual to act, interact and react is reinforced by this technology.

One of the benefits of computerized conferencing for educational purposes is its design flexibility. Through EIES it is possible to conduct objective data gathering through voting, surveys, estimation pooling, estimation consistency, and cooperative data bases. Secondly it is possible to do refined analyses through item tracking, structural modeling, simulation, modeling and graphics. Common group structures can also be accommodated through role tracking, gaming, nominal group techniques and brainstorming.

There is also software support for significant educational roles. User consultants serve as a vital resource for both new and experienced users. Group coordinators help to establish focused task attention. The conference moderator provides access and direction to conference participants. By permitting outsiders to have access to one's individual notebook either as full participant or as observer only, much necessary information can be transmitted.

Computerized conferencing has specific education applications which are supportive of traditional course design or newer learning systems. Traditional courses are supported through such features as: electronic office hours, coordination of large courses, curriculum design, electronic grade books, thesis advisement and specialized tutorials.

EIES is a sophisticated electronic conferencing system. Among its features are facilities for messaging, group conferencing, composition, joint authorship, selective retrieval of text, public announcement, word processing and text editing.

Electronic Mail and Conference Systems

There are a number of related systems as follows:

CONFER - A computer-based conferencing and messaging system developed at the University of Michigan. CONFER is designed for group decision making, discussions on a common topic and personal communication. CONFER provides facilities for group participation in conferences through item entry and commentary on items, private messages between individuals and personal reminders or memos.

CONTACT EMS - Stanford University's Electronic Messaging System. In addition to standard, memo type messaging features, CONTACT EMS interfaces with the powerful WYLBUR facility for text editing and creation and the SPIRES data base management system for document storage and selective retrieval. Users can if desired be configured in a read-only mode so that they need only log onto the system to receive messages automatically.

EDUMAIL - Edunet's electronic communication system which uses Wisconsin's MACC mail facility. Users can compose, edit, copy, send, receive, print and file messages. Messages can be sent to a single recipient or to a group of recipients. Status reports of incoming and outgoing messages are available at any time.

Hermes - An electronic messaging system developed with support of the Department of Defense for use on many of the ARPANET host computers. Hermes includes many advanced features such as message display profiles and templates for customized use of the system. University of Southern California.

MS - A computer based system for sending and receiving messages to and from other users, MS provides facilities for creating, sending, filing, and retrieving and editing messages. Experienced users can tailor MS to suit individual styles and tastes, yet it is self-documenting and easy enough for novices to use. Carnegie Mellon (EDUCOM), 1982).

Communications set up through these interactive systems serve a number of levels of need. The first is the exchange of messages whereby a dialogue is set up between contributors of selective, fragmentary and occasional information about the conduct of their own particular activities and having no meaning outside the context of these activities. The second level would be one wherein the opportunity is presented for more detached discussion in which study groups would be formed to exchange ideas, to work out analysis, arrive at assessments and make decisions. This cumulative process permits the establishment of a collective memory to which the individuals can refer as frequently as needed. Because of the ease with which materials can be inserted and extracted, newcomers to an institution can readily join in the system and benefit from the accumulated wisdom already incorporated within the memory drawn from that particular group.

PROFESSIONAL DEVELOPMENT

One of the most immediate potential applications of computerized conferencing is to dispersed educational development. Through the asynchronous mode and the provision of an interactive continuing editable transcript, the instructor and participants can remain stationary with information itself travelling. Although efforts in this areas are only now beginning to emerge, there is potential for transforming for some already existing educational efforts. The delivery of vocational strategies were described by Jackson to overcome problems of delivering vocational programs in small rural schools. The study was designed to provide easy adaption to local use. Strategies of cooperative schools flexible scheduling, use of television and radio, learning systems, correspondence studies, mini courses, learning on athletic trips, teacher exchanges, conference calls, computer-assisted instruction, independent study, and programmed activities were all used (Jackson, 1978).

The current activities of Nepal would lend themselves very easily to computerized conferencing. Beginning in 1971, the International Education System Plan was undertaken in Nepal to modernize education. Emphasized most strongly was vocational education to meet the country's technical manpower needs. The attempt was undertaken to make education more relevant to the needs and aspirations of Nepal by linking education with productive enterprise and egalitarian principles. The result was reorganized school programs including work programs integral to the school curricula, character building, pre-vocational training integrated with school curriculum. The earning while learning program and the plan to involve vocational education students in local development projects could easily have been planned and coordinated through computerized conferencing. Given the sometimes limited numbers of skilled professionals available for instruction, the use of on-line conferences would permit the broader dissemination of knowledge at reduced cost.

To date, little formal adult education exists in Nepal, but government agencies, cottage industries, private agencies and national youth programs provide a small percent of the out-of- school population with crafts, religion, agriculture and literacy training. Centered in the schools and youth organizations are several projects including the education for rural transformation and the Badikhel drinking water project (Nepal National Education, 1978).

Another example of the use of teleeducation was summarized by Hammond in considering the activities at the British Open University. Large numbers of students at the Open University of England are prevented from having any higher education by factors such as geographic remoteness, physical disability and financial or family obligations. Most are full-time employees and or raising a family.

The Open University communicates via mail or radio or television. Students may attend tutorial regional student centers once or twice monthly or attend summer school. Telephone teaching provided the first opportunity for involving students in tutorials, discussions and self-help programs. Equipment allowed up to eight students and tutor per discussion out of their homes.

The major reason for taking part in conference calls was that leaving home or meeting new people at the study centre was difficult when evening or shift work clashed with normal tutorial time. The overall structure of the conference call was dependent upon the leadership or teaching style of the tutor. Some calls followed a pattern of lecture and discussion, while others were more informal. Individuals were asked to identify themselves when asking a question. Tutors invited named individuals to respond. Due to structured conversation, more individual participation was encouraged.

It was more difficult to describe via conference calls such subject matters as the sciences. Some felt telephone contact was restricting; some felt that the tutorial group was threatening at the centre and felt more at ease with conference calls. Some who did not readily use telephones were unhappy with having to rely on the phone. More tutors felt that the main advantage was bringing study centers via phones to those who would otherwise not have been reached (Hammond, 1978).

Computerized conferencing has also been applied to executive development and continuing education. The Western Behavioral Science Institute based in La Jolla, California uses computerized conferencing through the EIES network to run multi-disciplinary development courses for high level industrial and government leaders. They are able to draw upon an international faculty as well as an international study body to participate jointly in a learning experience. A special benefit is that the entire range of transmissions remains intact for review and modification at will. In addition, the mechanism of computerized conferencing permits a broad degree of participation between participants and conference leader as well as between participants.

The New Jersey Institute of Technology is currently conducting a range of continuing education courses with a widely dispersed faculty as well as an equally dispersed student body. Courses that have been run thus far on EIES have included the following: HUMAN COMMUNICATION VIA COMPUTER; COMPUTER LITERACY: A GENERAL APPROACH; ALTERNATIVE LEADERSHIP STYLES; APPLE II MICROCOMPUTERS: BASIC AND DOS; ENERGY OPTIONS AND DECISION MAKING; HOT TO START OR ADVISE A SMALL BUSINESS; LOCAL AREA NETWORKS; MATHEMATICS FOR FINANCIAL INVESTMENT; PASCAL PROGRAMMING: AN INTRODUCTION; PERSONAL DEVELOPMENT PROGRAM; THE SCIENCE FICTION CONNECTION; SELECTING AND EVALUATING MICROCOMPUTERS; TECHNICAL WRITING FOR PROFESSIONALS; TECHNOLOGICAL FORECASTING METHODOLOGY; TRS80 MICROCOMPUTERS: BASIC AND DOS; VIEWS OF THE FUTURE BY FUTURISTS.

Additional programs that have used the EIES network included the following which were designed as a series of seminars for the college faculty of eleven East Coast liberal arts colleges: Computers AND SOCIETY; CONTEMPORARY MANAGEMENT ISSUES; COMPUTERS AND EDUCATION; COMPUTERS IN UNDERGRADUATE EDUCATION; ELECTRONIC CLASSROOM; COMPUTERS IN FOREIGN LANGUAGE INSTRUCTION; ACADEMIC INFORMATION SYSTEMS; COMPUTERS IN TEACHING COMPOSITION.

The implication of this for educational transmission is most provocative. One can begin to envision an international university of the future that transcends national boundaries.

Computerized conferencing can be of benefit to education on a number of levels. It can be used for teacher training and development, for conventional course transmission, for management development as well as for continuing education. The courses can run as short or as long as is necessary which may have special value for short-range projects of skill training.

In remote areas of the world where travel is time-consuming and expensive, as well as where there may be shortages of trained manpower, this would permit continued interaction for developmental purposes, and stretch the talent over broader terrains. The experience and insight of various locals can be helpful in providing examples and case studies to be generated for review and analysis by new neighbors and as yet unknown allies. This can well become the body of text for future sessions.

This is not a case of intellectual invasion but rather a new media of international collaboration. The representatives of developed countries have much to learn from the insights and experiences of their colleagues. Students of international affairs need to tap into the mainstream of contemporary experiences in developing countries.

With the increasing speed of research and development and the dissemination of knowledge, the person with a college degree no longer stays educated unless he continued to educate himself. It is no longer the unusually motivated individual who for intellectual satisfaction takes occasional courses in topics of interest to himself. No more is it the exceptional professor who feels the need to remain current in his discipline.

In an earlier era the learned monk in the confines of his cell could follow purposeful independent study. So too independent study was feasible for the Heidelberg student. Today, however, the rapid rise of technology and world wide demand for current knowledge, mandates interaction between scholars.

FACULTY RECRUITMENT AND RETENTION

Let use assume a university which had limited resources for the faculty in terms of library materials, data base searches, graduate assistants and few colleagues in the designated field. There would be difficulty in recruitment for faculty from more developed countries. The institution might also examine the option of providing more development for existing faculty. In this latter circumstance they might well benefit from participation in an interactive system of education between countries.

What computerized conferencing permits is the development of faculty within their own locale. Individuals within isolated schools or within specialized disciplines hunger not only for access to new data but also for interaction with those who have had similar training in their discipline. Those who have had similar academic preparation tend to have a common underlining and world view that can be shared without too much explication. There is a common lingo, a readily grasped jargon which lies beyond interpretation. Preliminary concepts do not need to be made explicit but can be simply referred to. Even in circumstances where no specific information is transferred, there is a special pleasure to the sharing of views between individuals who come from the same discipline.

In considering computerized conferencing as a mechanism for faculty retention there are two approaches possible. The first is to provide specific skills in a relatively cost-effective manner, such as discussed above. They can be rich in content and provide for interaction. The second approach is to use computerized conferencing for administrative purposes such as deliberating on issues of organization and planning on line. In both instances there is a subliminal purpose served of establishing a social network. This provides a ready inducement for new faculty to join and existing faculty to remain longer.

One must also reexamine the view of longevity in organizations. In many instances, there needs to be a necessary remnant of those who continue the history of the university and know its traditions. In the case of the developing country there need to be rewards and incentives even for those whose connection to the university is of short duration. It may indeed be well advised to bring in individuals on very short contracts to serve as bridge builders or catalysts for continued interaction. In such cases, even after the visiting professor has left, relationships that have been forged can still continue to the benefit of both.

POLITICAL IMPLICATIONS

> Data is not merely an intellectual commodity but a political resource whose distribution through new information systems affects the interests of particular groups... The system designer seeks to ask who owns the data, who will share it, what will be the perceived impact on redistribution, on evaluation, influence and authority (Kenn, 1981).

There are those who see education as a neutral good and those who see it as a powerful tool for the transmission of societal values. The truth lies between these views. What is here proposed is a scheme that adds to the transmission of information, the overlay of a communications network. This can lead not only to the sharing of a knowledge base that is discipline grounded but to a potentially rich level of interaction. If permitted to thrive, there can indeed be cross- fertilization of values and aspirations. Computers for educational purposes are indeed "powerful tools of a thousand faces" and those who see them only as drillmasters are as narrow as those who value only the computational aspects (Keen, 1981).

More than a replacement for the telephone, mail or face to face meetings, computerized conferencing provides a medium for expanding human resources. There is constant and convenient access. Yet in the worst case, communication technology may become a tool of the lite. Those who are already advantaged could become yet more isolated from the disadvantages (Hiltz and Turoff, 1978).

It may be feasible to concentrate on building from the most innocuous connection to the most complex. To link individuals within the same region who share common concerns on curriculum design may be broached without too much hostility. Once one begins to consider crossing regions or venturing beyond a single discipline, the resultant "untidy" interaction may be seen as setting the groundwork for uncontrolled discussion. It is essential that the direction for interaction be established by the individual entitities concerned, i.e. the region, the town, the discipline, etc. Again, where outsiders are invited to participate as consultants or advisers or facilitators, they need to make explicit the gains they anticipate receiving from such interaction. The reference to gains implies knowledge sought, field data, exchange of views, network building and so forth. Communication via computerized conferencing will only become substantive and persuasive if all participants have a value from such joint ventures.

While there are costs to this technology it should still be feasible even for countries with limited financial resources to participate.

> Observers, including tenured professors, are rarely indifferent to the fortunes of the organization where they find themselves. The strength of one's identification with organizational goals depends on a variety of factors such as position, career objectives, expectation of promotion etc. Political identification and patriotic sentiment also affect intellectual outlook. These influences are intensified when actions and beliefs are perceived to be linked with undertakings having very high stakes. A government charged with the task of forging regulatory policy is likely to have its own built-in biases and is probably subject to lobbying pressures from special interest groups. Thus the studies it commissions will inexorably be constrained from the outset in ways that will set predetermined limitations on policy options. Such limitations typically derive from government needs to balance the special interests of different constituencies but may also come from the tendency to perpetuate policies that have been found to be effective in the past. Economic considerations for example generally carry far more weight among policy makers than quality of life issues.
>
> ...Changes in the distribution of power induced by computer use has been a favorite theme of pluralists at least since Downs predicted that urban information systems would result in power shifts from lower- to higher-ranking participants in urban politics and government (Mowshowitz, 1981).

The term modernization has been subjected to numerous definitions. In the political context, it embraces the social mobilation process which involves a change in the attitudes, values and expectations of people from those associated with the traditional world to those common to the modern world. In order words, the term demotes the consequence of literacy, education, increased communications, mass media exposure and urbanization (Huntington, 1968). We should not be misled, however, that it is in the interests of all nations to foster collaboration. Literacy and mass media may too often fuel the fires of discontent and dissatisfaction. Further, if there is wide governmental reaction and resistance to information sharing and knowledge transfer, the risks for participation become too great unless care is given to sacrifice some degree of confidentiality. Broadly agreed upon categories can be transmitted without too much difficulty. Interpretation, however, becomes subject to considerably greater limitations.

Developing nations generally require analysis of skilled manpower requirements. From this analysis is derived the type and level of education required to meet this need. The assumption is that wages and salaries paid to workers closely reflect differences in their productivity (Blaug, 1967). This in turn derives from the level of education received by them.

The record of colonial involvement in education is not a happy one. Apparently the manpower forecasting approach which the German colonial administration to Cameroon and Togo applied had the ulterior motive of not only limiting the level of education of Cameroonians and Togolese but also of imposing the German language and culture on them. Similarly, the French colonial policy of assimilation aimed at creating in each territory a thoroughly Gallicized elite which would someday be able to aid in the administration of their territory (Gardiner, 1963).

The British educational system dominated by the missionaries had as one of its basic goals the conversion of the colonized through local leaders. The philosophical differences between the British colonial policy of indirect rule and that of the French, Crowder argues, was that France in the education of her elite aimed at producing French Africans whose loyalty to France and indifference to local nationalism could not educate the people of a colony without expecting them to ask for self-government (Crowder, 1968).

In order to respond to the anxieties of certain countries or political regimes to the too-rapid imposition of technology or perhaps improper connections with outside forces, one would have to stress first the equalization of comparable departments within a country. This should pose fewer problems since it is assumed that unanimity might more easily be achieved within a particular discipline within a designated region. One may however be overly optimistic. When cutting across various disciplines, there is likely to be more resistance from governmental bodies regulating access to telecommunications. And the ultimate configuration of linking individuals beyond parochial borders may be altogether too great a leap to expect at preliminary stages of a country's redevelopment. There is a difference between the goal of improving national learning or international knowledge. Perhaps one has to work sequentially here to develop the capabilities of institution and regional basis before further extension.

A few words are in order about some of the anticipated limits to acceptance by developing areas. Although there are advantages to the dissemination of knowledge broadly among faculty staff, there are also obstacles which tend to mitigate against its effectiveness. The distinction between the haves and have-nots within this same faculty may well tend to cause enmity. It is generally easier to be a member of a large group tied to the same morass of limited informational access than to be in a minority being exposed to a new technology. Another problem area may be the high risk that is run by beginning a new process or approach in an untried location. It will be hard for the individuals concerned to be able to determine whether the deficiencies arise from their level of competence or from the limits of the technology. A third aspect is the fact that more money must be expended in the initial stages of the project than would occur at a later stage.

There needs to be sufficient time for certain social interaction. This initial social framework makes it easier for others to commit to an ongoing relationship. It has been observed that most successful interactions occur when there has been some initial face-to-face interaction. This establishes a framework of obligation and responsibility which can more readily be avoided when one deals with total strangers. It is doubtful whether sufficient funds exist to permit the personal interaction to be followed by a teleconferencing mode.

For the more developed nations, exposure to technology poses less threat. All interactions are regarded as a means to an end. Where technology is less prevalent, the emphasis may be more strongly on the means. The novelty, responsiveness, and potential of creating a shared text can be quite dazzling.

Although this may be frivolous, the possibility exists of resistance to the technology because of the enjoyment itself. Some faculty members may feel that it is too costly and to inappropriate for colleagues to chat on-line. The emphasis may prematurely centre on the transmission of information and hard data, rather than upon the analysis and investigation of differing views.

The examples from colonial education are instructive. One may assume that there are still local leaders who while maintaining lip service to ideas of broad interactive learning, still recoil from the implications of an educated citizenry. The imprisonment of academics and the relegation of scholars to years of agricultural service do not bode well for broad peer interaction across boundaries. The technology exists that can foster and nurture scholarly interaction. It is not yet clear whether either developing or developed countries are prepared to embrace the concept today.

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The Introduction of Asynchronous Electronic Communication for Distance Education in Developing Countries: A Case Study in Thailand.

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Introduction

The success of the British Open University has provided both a model and encouragement for other countries in undertaking contemporary applications of formal adult education which go back at least to the University of London's external degrees in 1836. (Kaye and Rumble, 1981). During the past decade and a half, a number of developing countries such as China, India, Indonesia, Malaysia, Pakistan, Sri Lanka, and Thailand, have created institutions to give their adult populations the opportunity of a college or university education via distance education.

Ely (1987) cites four reasons for the rapid growth of this phenomena in developing countries. The first is the inadequate provision for post secondary learning opportunities for the majority of the population. In Indonesia, 250,000 fully qualified high school graduates annually are denied a post secondary education because there are insufficient teachers and classroom spaces. Secondly, people want to learn and this social pressure puts demands on governments to respond. Thirdly, Distance Education in this context appears as a cost effective means of meeting this demand. In Thailand, for example, a comparison of operating costs between restricted admission and open universities showed that the open university costs per student ranged between 2.13 and 11.35 percent of costs for similar programs in conventional institutions. (Srisa-an and Wangsotorn, 1985). Ely's fourth observation is that modern technological alternatives make educational delivery possible on a scale of unprecedented proportions. The Central Agricultural Broadcasting School of China began operations in 1981 and in 1986 offered more than 24,000 classes with over 800,000 students, (Chow 1987) the Terabuka University, Indonesia, in its second year of operation in 1985 registered 93,000 students and Sukhothai Thammathirat Open University, Thailand, reports in excess of 400,000 students.

Given the numbers of students these institutions seek to serve it is not surprising that frequently communication technology is seen as an immediate solution. The concept of the "University of the Air" was Harold Wilson's initial orientation in gaining public attention for what was to become Britain's Open University. However, as stated by Bates (1984) "the concept of the Open University was always more complex than the notion of broadcast courses". In contrast to the popular misconceptions about the use of broadcast courses, the Open University has used broadcasting for approximately 10 percent of a student's study time with the printed text paramount as the information source for students. While the Open University is exploring the use of newer communication media, including computer conferencing, its basic teaching system has changed little since its inception in 1971. This suggests that a successful application of communication media needs to be appropriate to the task and to treat with caution some of the more excessive and flamboyant claims for some technologies.

The Nature of Distance Education

The main characteristic of distance education is the separation of learner from the teacher for most or all of the teaching learning process leading to non-contiguous communication. (Holmberg, 1981). In reviewing the work of a number of authors on distance education, Keegan (1986), concludes that distance education is characterized by:

i) the quasi-permanent separation of teacher and learner
ii) the influence of institutions in planning and providing learning materials and student support services;
iii) the use of technical media to join teacher and learnerand to carry the course content;
iv) the provision of two-way communication between teacherand student;
v) the absence of a learning group so that people are taught as individuals and not as groups. In some settings occasional meetings for didactic and socialization purposes may be provided but the major focus is on individual study.

This paper will focus on the provision of two-way communication between teacher and student and the role of technical media to facilitate that exchange. This is seen as quite separate and distinct from much prevailing use of technical media to provide a one-way flow of information from teacher or teaching institution to the student. Print, radio and television have been used as the principal means of information delivery in distance education with print in most cases the dominant form. Student assignments completed and sent to be marked provide the two-way communication link. Since this is usually achieved by mail there is a long delay between the student submitting the material and receiving the response or feedback. In this form of correspondence or distance education the communication is asynchronous in the extreme and is the corollary of the basic characteristic of the separation of teacher from student or "teaching behaviors" from "learning behaviors". This includes not only assignments and tests which in the conventional setting also represent asynchronous communication but also those interactions in the classroom, tutorial or counselling session in which the communication situation is contiguous. (Moore, 1973).

The Need for Active Learning

McKeachie (1986), in a classic guidebook for college and university teachers summarizes a number of experiments in learning by stating that "active learning is usually more efficient than passive learning" and attributes this to the improved opportunities for feedback in active learning. He further argues that while students must practice if they are to acquire new intellectual skills it is also essential that they see the results of that practice and from it gain information about what to do as a consequence. The separation of teacher from student in a distance setting increases the separation from practice and knowledge of results and would seem to be a major problem impacting on a student's self-concept, motivation and general learning proficiency in distance education. Apps contends that mature adult learners are in need of feedback from the instructor on their progress or lack of it and "to wait until the first major examination or the completion of a major term paper before feedback is provided is unfair." (Apps, 1981). This is the situation which confronts many students in distance education. In October 1986 the author had the opportunity of meeting a group of middle school English teachers in China's Northeastern province of Heilongjian, who were studying English through the Central Broadcasting University. In discussion about the degree of satisfaction they were receiving in their studies the response was a unanimous "not satisfied". Upon probing it emerged that lack of knowledge of achievement was their principal complaint. Although to a native speaking English person their ability with the language was quite commendable, for the students the lack of regular feedback was unsettling.

Much of the current attention on technology in distance education appears to focus on delivery systems such as broadcast or satellite delivered radio and television. (Jayaweera, 1985; Casey-Stahmer and Goldschmidt, 1985). Some attention is being given to database access but in the context of developing countries this is a long way from being a practical option, (Darrow and Saxenian, 1985). Hechinger (1985) reporting on a conference sponsored by the Mexican Ajijic Institute of International Education claimed that "advances in communications and information technology have been of little help to developing countries trying to educate their children and illiterate adults and train their unemployed". Educational television, it was reported, reaches less than one per cent of the potential audience. It was also stated that much of the problem lies with an abundance of hardware and a paucity of content or software. With these cautions in mind it seems essential that projects be mounted which concentrate on enhancing active learning and participation and to explore the role of technology to achieve these results.

Distance Education in Thailand

The earliest attempt to increase university access for non- traditional high school learners occurred in 1933 with the "open admissions" system at the University of Moral and Political Science subsequently renamed Thammasat University. It was characterized by no entrance examinations and no compulsory attendance. However, over the course of time it became a conventional system with closed admissions.

In 1971 Ramkhamhaeng University was created as a campus based "open university" but by 1979 when its enrolment reached 110,000 the limitations of its physical facilities indicated the need for a second campus. Instead of expanding Ramkhamhaeng's capacity for campus-based instruction a new institution Sukhothai Thammathirat Open University (STOU) was created by the Ministry of University Affairs, Thailand, in 1979 to extend post secondary learning opportunities to the adult Thai population by combining the concept of "open admission" with the educational delivery mechanisms of Distance Education. (Srisa-an, 1983).

STOU serves the entire country with a population of 50 million of whom 80 percent live outside major urban centres. In its first year of operation, 1980, STOU enrolled 82,139 students and in the first semester of 1985 its enrollment was 173,350 students in its ten programs. The total number of adults served by STOU distance teaching system now exceeds 400,000.

Admission to STOU is open to holders of lower secondary certificates who are at least 20 years of age with 5 years of work experience. Applicants with secondary school certificates or university degrees are admissable on the basis of these credentials.

The academic program of STOU is provided through ten schools which include Agricultural Extension and Cooperatives, Economics, Educational Studies, Health Schience, Home Sciences, Law, Liberal Arts, Management Science and Political Science. Administration and academic support is located in the Office of the Rector; Offices of Academic Affairs; Educational Services; Educational Technology; Registration, Records and Evaluation; Information and Documentation and the University Press.

The distance teaching system is based on the principles of instructional technology as illustrated in figure I.

The major medium of instruction is the printed text supplemented by radio and television broadcasts and audio cassettes. Tutorial sessions are provided in 85 regional and local study centres distributed throughout the country. The study centres are located in the facilities of colleges, provincial universities and senior secondary schools and operated on weekends when the schedule of those institutions has spare facilities available.

The courses are designed by course teams comprising several academic subject specialists, an instructional technologist and an evaluation specialist. The academic staff at STOU is modest in relation to the numbers of students served. In 1985 there were 127 permanent staff and 487 administrative/support staff. (Srisa-an and Wangsotorn, 1985). Academic staff responsibilities included course writing and supervision of tutorial staff. In addition approximately 5000 part-time staff are recruited annually from local institutions to serve as tutors and markers.

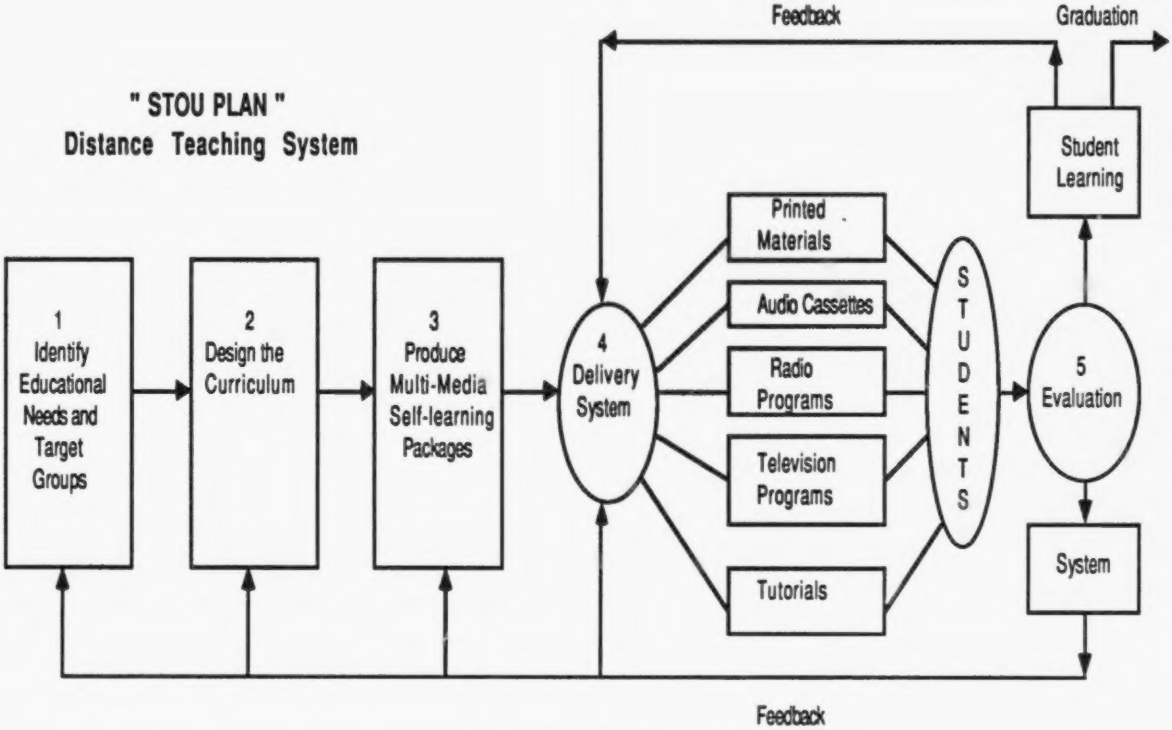
" STOU PLAN "
Distance Teaching System
Feedback
Graduation
Student Learning
1 Identify Educational Needs and Target Groups
2 Design the Curriculum
3 Produce Multi-Media Self-learning Packages
4 Delivery System
Printed Materials
Audio Cassettes
Radio Programs
Television Programs
Tutorials
S T U D E N T S
5 Evaluation
System
Feedback

FIGURE 1

A Pilot Project In Asynchronous Electronic Communication

In 1985 the author, in association with colleagues at the University of Guelph on the invitation of Sukhothai Thammathirat Open University, embarked on a pilot project to test the appropriateness of a microcromputer based self-testing system for remote learners in the regional study centres in rural Thailand. The theoretical basis for the project is found in Keller's Personalized System of Instruction (PSI) or Keller Plan. (Keller, 1968; Leppman and Herrmann, 1982; McKeachie, 1986). The basic features of PSI are the use of printed materials for teacher to student communication, the concept of mastery, self-pacing, frequent testing and knowledge of results. Superior performance on content learning, as measured by examinations is frequently reported for PSI and in one series of studies, Leppman and Herrmann found students taught by PSI achieved final examination scores consistently one letter grade higher than students in conventional classes. The PSI students took the examinations prepared by the teachers of the conventional sections of the same course. (Leppman and Herrmann [1982]). The frequent testing and immediate feedback is the feature supported by research in achieving this type of gain. (Kulik, Kulik and Smith, 1976). McKeachie (1986) concludes that PSI has "probably had more impact upon college teaching in the 1970's than any other innovations". Despite its demonstrated value the high cost and difficulty of providing the frequent tests and immediate feedback by instructional staff makes it unattractive on economic grounds. One of the characteristics of computer assisted instruction is the capacity to provide a remedy for repetitive tasks so much so that the computer has come to be regarded as a "tireless tutor". If a computer based testing system could be developed and made operational in the context of distance education study centres, at reasonable cost, it should contribute to improved learner performance. This assumption and the principles of PSI provides the basis for the STOU pilot study.

The experience of Sukhothai Thammathirat Open University revealed that in its basic science, mathematics and statistics courses, which each enroll upwards of 20,000 students per year, a high percentage of students were failing to achieve a satisfactory level of performance. In these courses, insufficient tutors were available in the local and regional study centres to deal with the students communication needs and this project was undertaken to develop and test a microcomputer based "electronic tutor" to enhance asynchronous communication between teacher and student.

The purpose of this pilot project was to investigate the feasibility of using a teacher controlled microcomputer-based instructional system in the high enrollment distance education system of Thailand offered through STOU.

The objectives of the project were:

1. To establish counterpart research and development teams at STOU and Guelph which would interact through short on-site working visits at each other's institution and to maintain continuing communication through the COSY conferencing system as transmission capability was achieved.
2. To establish a computer-based courseware development capability using the course authoring system developed at Guelph, VITAL.
3. To develop test modules to accompany the existing instructional modules in at least two course blocks.
4. To monitor and evaluate on a formative basis the achievements and difficulties in the progress of the project.
5. To test the course materials developed by the project in a trial in each of three regional study centres of STOU.
6. To evaluate the results of the first trial in terms of student attitudes and experience in using the system, student achievement, impact on faculty work loads and work patterns, and cost benefits.
7. To replicate the trial after incorporating the evluation findings from the first trial.

The authoring system used in this project is the University of Guelph's VITAL system (Versatile Interactive Teaching and Learning) and is described elsewhere (Moore, 1986). This is a microcomputer-based authoring system using Telidon/NAPLPS as the display offering color graphic capabilitiy. VITAL has been found to offer substantial reductions in the time to create courseware in comparison to other computer-based instructional systems and in the per student hourly operating costs. (Moore, 1987).

Project Achievements

The project is at the point of having substantially achieved its first three objectives and is moving into the field test phase. A donation of computer equipment by IBM-Thailand for the courseware development and field testing and the research and development funds of STOU have provided the financial support. Through an Institutional Cooperation Agreement, Guelph has provided 13 weeks of faculty and professional/technical staff time for training and development at STOU. STOU has established a project production team comprising academic coordinator, operations manager, equipment specialist, a data base manager and eight designer/operators. It has sent five of its staff to Guelph for a total of 6 weeks training and evaluation.

The first objective to establish counterpart research and development teams has been achieved to the extent that an academic coordinator at STOU has in place a group of teams to collaborate on the project. The intended COSY conferencing unit is not yet in place due to direct telecommunication limitations between Canada and Thailand. This has restricted the communication between STOU and Guelph researchers to telex, mail and occasional site visits. A major development funding proposal is pending, but without supplementary resources the interation between the development teams of the partner institutions, as provided in the formal Institutional Cooperation Agreement signed between STOU and Guelph, remains at a modest level. The potential for improved research communication exists via computer conferencing but awaits direct country to country telecommunication linkage before implementation.

The second objective to establish a computer-based courseware development capability has been achieved at a high level of technical proficiency. The training of the production team to use the VITAL authoring system was achieved in two on site training periods of two weeks duration each at the STOU headquarters outside Bangkok. This training was consolidated by the appointment of an operations manager. This appointment was made from the Office for Educational Technology of a recently returned graduate with a Ph.D. in Graphic Communication.

Instruction in Thailand is in the native language and this necessitated the development of a Thai character set and its incorporation into the VITAL authoring system. This was achieved early in the project through the redefinable character set capability of Telidon/NAPLPS and subsequent incorporation into the program software. This now exists as a separate VITAL-Thai version of the authoring system.

Telecommunications and data transmission between the STOU headquarters and the remove study centre test sites could not be established within the project resources and the courseware has been made operational on a VITAL facility called TOAD (Teaching on-a-disk). This is a boot disk for drive A containing a NAPLPS decoder and VITAL read only software. Course modules loaded on drive B are then read and displayed with the same interactivity as possible on a fully networked system. One restriction is the immediate entry into course records of the information pertaining to each students test performance. While TOAD does record individual responses for compilation later, this is not seen as a serious deterent since the purpose of the tests is to provide immediate feedback to the students rather than the accumulation of test grades. The use of TOAD eliminates telecommunication costs in the cost analysis.

The STOU production team has worked with academic staff in the course teams in Basic Science, Mathematics and Statistics to develop 15 minute test packages in each of three assigned course blocks. The resulting modules reviewed by the Guelph team have achieved a high level of technical proficiency and have confirmed the hypothesis that instructional and technical support staff without computer programming skill can create usable computer based courseware through an authoring system with minimal external input and supervision. In the case of STOU, the resulting modules have taken advantage of the color and graphic capabilities of VITAL and done this in the native Thai language.

The remaining objectives are being addressed as the project moves into the field trial phase.

Conclusion

The achievements of the STOU-Guelph project to date support the position that a relatively low cost computer-based instructional capability can be adapted to meet the requirements of distance education in a developing country - to be determined is the extent to which this system can enhance student performance in an existing distance education delivery system by providing improved

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asynchronous communication between the "teaching behaviors" and "learning behaviors". Also to be determined in this context are the impacts on academic staff work patterns, workloads and the cost implications.

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3rd Generation Distance Learning

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ABSTRACT

A consortium of educational institutions and technical institutes have developed a concept of distance learning called **3rd Generation Distance Learning**, based upon a computer-mediated communication system, in this case the Swedish PortaCOM-system. The system, however, is also used for purposes not strictly educational; project coordination, and group decisions in administration are examples of other uses. This system is running on a commerical basis. Soren Nipper has been project manager of this consortium since February, 1985.

SOCIO- PSYCHOLOGICAL ISSUES

Attitudinal Changes Through Computer Conferencing

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ABSTRACT

When twenty-one elementary women classroom teachers computer conferenced with each other and twenty O.I.S.E. students to discuss gender bias in computer use for a four month period, the experience changed not only their own attitudes but also those of their administrators, colleagues, family members and students. Those involved in encouraging others to become involved in computer conferencing will benefit from this summary of both planned and serendipitous attitudinal changes which resulted from the project.

Project Description

In January 1986, the Federation of Women Teachers' Associations of Ontario (FWTAO) began a unique project in cooperation with the Ontario Institute for Studies in Education (OISE) which involved linking twenty-one members of FWTAO with each other and seventeen OISE students taking an on-line graduate course about women and computers in education.

The Women Educators' Computer Conferencing Research Project had the following objectives:

1. To identify and document gender differences in the use of computers by students;
2. To develop strategies for encouraging female students in their use of computers;
3. To provide an opportunity for women teachers to develop their confidence in using computer networking technology;
4. To develop positive female role models in the use of computer technology;
5. To study the experiences of women teachers who participate in a computer conferencing network.

Dr. Linda Harasim acted as the conference co-ordinator and research assistant and Dr. Dorothy Smith was the professor delivering the OISE course on Women and Computers. Their reports on "The Women Educators' Computer Conferencing Research Project" are listed in the bibliography. These reports outline the process involved in setting up this research project and the results of the study of gender bias in computer use in schools as was intended at the start of the project.

This report, however, presents information about the attitudinal changes which were observed by the three authors from our perspective as participants with and leaders of the FWTAO members in the project along with the observations of the FWTAO participants themselves.

Sex-role stereotyping in school and Gender Bias in computer use

Before being selected as one of the participants in this project, each FWTAO member was required to submit a three to five page essay outlining what she would have to contribute to such a project and what benefits she would expect from her participation. Most participants indicated that they believed that they were quite aware of gender differences in computer use. Such comments as the following show this belief:

- In my own classroom, the girls have been encouraged to use the computers and are now beginning to feel less intimidated by the boys.

- My own observation of this is that in the primary grades, girls have the same interest in using the computer as do the boys. However, by the same intermediate grades, girls seem to lose interest.

- Female students need role models if they are to perceive computers as non-threatening.

- It is important for children to perceive women as able as men, to master computer skills.

- During a course I learned a great deal about the difficulties most girls face in achieving equal opportunity in the use of computers in the schools.

In addition, several were aware of attitudes amongst their colleagues which did not endorse women's involvement with the computers as the following comments indicate:

- Just last week, an administrator advised me that I was a sort of oddity - a woman who could handle the technical challenge of computers.

- I am the computer liaison person for our school---and a member of the Computer Program Council. On this council I am the only woman to serve along with eleven men.

- I am trying to establish a network for women teachers to inform and encourage each other in our work to improve your women's attitudes towards math and science.

Even with this level of awareness in evidence at the start of the research project, attitudinal changes were evident by the end of the project.

- Like other participants, I thought I was as aware as necessary of the whole gender issue - was I wrong! The way I perceived bias was almost totally dependent on what was wrong, without addressing things that were errors by omission of women/girls and their experiences.

- In intermediate division next Fall, my computer use with students will be much less casual and much more aware of the girls.

- I felt I was aware of gender differences --- after doing readings for the first two sessions and also reading opinions of others on line I became much more aware.

- By the second week, I had changed my teaching patterns in school using this awareness.

- I began believing that the only area to address was to increase the number of female role models; my emphasis has broadened to consider equally the impact of curriculum content and students' attitudes.

- My awareness has been fine-tuned to notice hidden areas of sex bias.

- I thought gender roles were hardened by kindergarten - I am heartened to see they don't seem to be with computers.

- The discussion (on line) made me much more aware of issues and I became more vocal in discussing the issue of bias with my students.

- I became more aware of issues related to women and technology outside of education - I had much too narrow a view.

- I am more conscious of language used and opportunities offered to students in all areas and how they might be gender affected.

- I was not aware of the gender differences at the beginning of this course - now I am much more aware of this issue.

- I have re-evaluated lesson-plans activities, worksheets and assignments given to students and try to use non-sexist terms.

- My empathy level in relation to women's problems was not as intense.

- I became more aware of issues related to women and computers - -- I observed that the boys were much more assertive in doing what they want on computers --- I found that I have had to intervene on behalf of the girls making sure they have their turn using the computers, with printers, using the more popular software etc.

In addition, some participants noted that certain computer software was more adaptable and useful in curriculum activities.

- I became more aware of the types of software and started to assess the software I was using in class.

- My assumptions regarding software use in curriculum areas were in some cases supported i.e. word processing, and in some cases revised - special education.

Themselves as Computer Users

Participants were asked to assess their attitudes towards the use of computer technology to hold a conference as well as their own attitudes about their facility with the technology. Considerable change was evident in the participants' comments which follow:

- Having been on "bulletin boards" before I thought I had the system "down pat" -- conferencing was quite different.

- By week 5 I tried to experiment with other functions - at the beginning of this course I had no experience using a modem or networking.

- Started with minimal working knowledge of modem and networking - after six weeks - successfully printed out presentation - felt great! - by end of project felt very comfortable.

- At first I was very nervous - the first "log on" was very tense. Now as I long on it is second nature. At first I felt I had to respond just to prove to the organizers that I was really there. Now I respond only when I feel I have something different to offer.

- In the beginning - state of ignorance - knew the medium existed - didn't know anything about hookup, software, how to log on, how a conference functioned. By the end, very comfortable.

- Start -- didn't have a thorough understanding of the capability of terminal software - Outcome - confidence that I would be able to troubleshoot and use any networking system I wanted to.

- Started off knowing nothing about electronic networking. Main gain has been in confidence - I'll try almost anything, attempt to connect for the fun/challenge of it.

- Once on line and into discussions I became totally involved -- confidence and success.

- Very nervous at first - slow to get on. Very excited one on- line. There was a sense of expectation - never lost this feeling throughout this course.

- The necessity of having to overcome technical problems gave a greater wealth and depth of technological growth.

- From knowing nothing about using modem and software for networking, I am now fairly proficient at it.

In addition, participants began to recognize the potential of conferencing in this format for student learning and teacher professional development. Some clearly wanted to continue this method of learning/sharing after the project ended.

- The only concern now is with finding the best way of keeping up the experience.

- Purchased my own modem at the close of the conference.

- I figure nobody else seems to know much about it, I have nothing to lose and there's such an interesting world out there to join.

- As a tool conferencing has definite possibilities for idea- sharing at Senior and professional development levels. Excellent mode for idea-sharing once the necessary modifications to reading and responding habits have been mastered.

- Now I have a great deal of knowledge to maintain and share but no way to do so.

Administrators

Significant attitude changes occurred in others who were not directly involved in the project but who were involved with the women who did participate.

- My principal seemed to take my suggestion about computers more seriously.

- In response to encouragement from administration, I became much more active in a resource role to the school and region.

- Personnel at the school board office from technicians to computer consultant and superintendents know about the research project and have learned about some aspects of it.

Colleagues

- Those I showed the process to expressed interest, asked about progress as time passed. Teachers had some awareness of the potential of this method of conferencing.

- I spent more time discussing issues with friends and colleagues and it sparked more staff room discussions on gender issues.

- More staff members are now using computers.

- I shared some of the on-line discussions re role models, gender paths, and affirmative action with staff members. They are re-evaluating how they interact with boys and girls.

- I tended to chat up the course wherever I went - several colleagues gave me other contacts who network.

- Many men were surprised that a group of women could be so knowledgeable about computers.

- I could sense the awe in the voices of teachers that reacted to the technology e.g. "You mean you're actually into VAX at OISE?" "Mind boggling". etc.

- All decisions for computers are made after I have been consulted.
- Teachers became totally reliant on my choosing what software they should use in the classroom.
- Gained more respect from many of my colleagues.
- Teachers on a staff certainly become more aware of gender differences as the course progressed.
- Many women more women in my school are using computers.

Family Members

- At first my husband was only casually interested, now he spreads the word almost as much as I do.
- My spouse and my children were often involved in my conferencing. We discussed issues at the dinner table and they too were made aware of the issue.
- My husband has learned a lot about conferencing and the problem of gender inequity. He now finds himself engaged in conversations about women and computer use and even quotes some of the experiences and research from on-line.

Students

- My female students seemed to become more comfortable on the computers.
- My Grade 8 girls used to stand back and let the boys take over (peer pressure) but now they seem to work well together.
- My grade 4 girls were indignant at the idea that older girls were less involved with computers than boys - no way will that happen to them!
- Students became interested in on-line possibilities.
- My "learning disabled" pupils can use a computer without assistance. They assist other students with new programs or activities.

It is clear from these comments excerpted from the participants' own assessments of changes which occurred in themselves and those around them that involving any individual in such a conferencing project has some intended as well as some unexpected benefits in changing attitudes. The one person's involvement tends to increase the interest and involvement of others in the use of the technology as well as in the exploration of the issue being studied. While one is educated about the technology and the issue, others are learning too. In addition, since all of these participants were women, there was an increase in their own confidence with computers, their willingness to speak up about the issue being studies and their own sense of respect amongst colleagues. This kind of study can be very valuable for those who study in isolation or those who are less willing to take risks. Given some basic training in the use of the technology, they can become role models not only for youngsters but also for colleagues and administrators.

The three authors would like to add the following observations from our perspectives:

- Conferencing over a period of time with a medium which allows for rereading materials on line or printing them provides opportunity for assessing beliefs, reexamining attitudes and changing one's point of view. The continuing interchange of opinions on line allows each participant to contemplate the issue more fully than they might at a one- or two-day face-to-face conference.

- Some participants commented, but did not include in their written evaluation, the observation that on-line conferencing eliminates some of the barriers to communication which can occur at a face-to-face conference. Usually, some people are more forceful in speaking, quicker to respond while others have little time to contribute. Some communication styles are less effective and the contributions of those individuals are less well received. Computer conferencing allows each participant to contribute on an equal basis and to get equal "air time". This can be a significant factor in attitudinal change since many challenging theories can be rejected simply because the messenger's style or personality is not well accepted, or because the listener responds too promptly. Anyone who is attempting to form or change attitudes will find the computer conferencing format a useful one.

- Computer conferencing changed attitudes not only about the issue being studies but also about the capacity of the learner. We saw comments from individuals who marvelled at their own capacity to acquire facility with the technology and to thrive on this interactive mode of learning. The usually problem with "networks" is getting people to participate. There was no problem with this group. Typically, users start out as readers and take up to two months to begin to write items on a regular basis. With this group, within the first 1 1/2 weeks the participants wrote 400 conference comments and 900 personal notes. Therefore, the typical reluctance to use the technology was rapidly eliminated. Indeed, the participants were eager to learn extensions of the capacity of the conferencing method and created additional ways for communication to occur.

Conclusion

Computer conferencing is an effective method for studying a challenging issue, examining various opinions, evaluating one's own views against those of others and growing towards a different attitude. Conferencing on-line is also an ideal experience for those whose reluctance to use technology has to do with the belief that computer use is "too machine oriented" or "dehumanized". Conferencing invites expanded exploration of the facets of the technology which will allow the participant to interact more effectively and therefore influenced attitudes about the technology as well as the issue.

Computer Conferencing: Its Impact On Academic Help-Seeking

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ABSTRACT

Seeking help when needed is an integral part of the learning process. A three-stage help-seeking process is described. Next, computer conferencing in academic contexts is examined and found to possess several characteristics which promote help-seeking. These include the admission of inadequacy, the decision to seek help, and its ultimate acquisition. Conditions which moderate the potential facilitation of academic help-seeking are discussed. Among these are the degree of co-operation vs. competition and instructor and conference participants' reactions to requests for assistance.

INTRODUCTION

Computer conferencing has the potential to alter fundamental organizational patters (Stevens, 1981, 1986). This is certainly true at educational institutions where campus-wide and course- specific conferencing can enhance existing communication channels and create new ones among students and faculty. The implications of conferencing for classroom instruction was noted quite early in a perceptive analysis by Heydinger (1978), based on experience with CONFER, which outlined both the advantages of conferencing and obstacles to its use. Since then, experience with conferencing systems on many campuses appears to substantiate claims that it can be an important pedagogical innovation, even a substitute for face-to-face contact, as evidenced by its use in distance education and virtual classrooms (e.g. Harasim, 1986); Hiltz, 1986a, 1986b).

Since we understand the major parameters of conferencing and the general principles of conferencing applications in educational, as well as in other settings Ie.g., Hiltz & Turoff, 1978; Kerr & Hiltz, 1982), it is perhaps time to begin to focus on ways in which conferencing influences some more specific aspects of student behavior in academic environments. To that end, this presentation will examine the way that conferencing affects an important facet of student learning: academic help-seeking. Academic help-seeking refers to behavior designed to remediate the lack of information and/or skill necessary to accomplish academic goals. After further describing the importance of this behavior and some features of academic environments, the help- seeking process will be detailed, along with the potential impact of conferencing at each stage. Conditions which influence the effect of conferencing are also discussed. The ultimate goal is to make users of conferencing in educational contexts more sensitive to help- seeking itself and the ways that practitioners of conferencing might configure their systems to facilitate the effective use of help- seeking as a learning strategy.

HELP-SEEKING - THE ACADEMIC CONTEXT

The amount of material that students are required to master in most academic settings makes it almost inevitable that even the best will occasionally need help. In face, in a recent study, 94% of the university students samples (N = 612) admitted they needed academic assistance during an academic term (Karabenick & Knapp, 1986). In addition, there is evidence that many students who need help fail to seek it. In the same study, 24% of the students in need got no help at all, and many others sought only minimal assistance. These data are consistent with studies indicating that the extensive array of academic support services available at most colleges and universities (e.g., Lenning, Beal,

& Sauer, 1980; Pascerella, 1982) are underutilized (Pantages & Creedon, 1978). The potential consequence of not obtaining needed assistance is lower performance and even academically- based dropout. Thus, the importance of examining the effect of conferencing on that critical behavior.

CONFERENCING AND THE HELP-SEEKING PROCESS

Within the past few years, the major factors that influence whether help will be sought have been explored (cf. DePaulo, Nadler, & Fisher, 1983). However, only recently have analyses and studies focused on educational contexts (Ames & Lau, 1982; Karabenick & Knapp, 1986). Models of help-seeking (e.g., Gross & McMullen, 1983) generally divide the process into an initial stage in which persons perceive that they have a problem (i.e., that they need help), a second stage which includes the decision to seek help, and a final stage which involves strategies for obtaining it (including surveying available helping resources). There is no assumption that the stages are always sequential nor invariably transitive. That is, stages may be omitted entirely and later stages precede earlier ones. Nevertheless, the sequence of stages is probably typical and, at the very least, represents a heuristic for explicating the process.

Is help needed?

The perception that one needs help is, in itself, a complex process in which an individual decides that he/she does not have the resources necessary to accomplish some goal (Rosen, 1983). This amounts to admitting some degree of inadequacy. Determining need occurs at two stages in academic environments: during preparation and after formal testing. For example, students (good ones at least) monitor their comprehension when studying - asking whether they understand the material. Not being able to understand may indicate the need for help. Assessments of inadequacy also occur when receiving performance feedback (e.g., test grades) - a poor grade may signal that help is needed. This might seem quite straightforward: an inverse relationship between performance and need.

However, deciding that one is inadequate is typically based on more than performance outcomes alone. We know from work in attribution theory (e.g., Weiner, 1979, 1985) that perceptions of the causes of outcomes are critical and that the search for causes is especially likely following negative outcomes (e.g, poor performance). Common attributions are to ability, effort, task difficulty, or luck. For example, assume that a student receives a low exam grade. Determining that help is needed would depend on whether poor performance is attributed to a tricky or difficult exam, to not having studied enough or to a lack of ability. Attributing poor performance to the lack of ability would be a clear admission that help is needed whereas attribution to the lack of effort would not.

Most important, attributions rely on information about how others have performed and the circumstances of their performance. For example, students trying to determine whether they were poor writers upon receiving poor grades on a short story might wish to know the grades of other students as well. If they learned that everybody else in class received poor grades it might indicate that the instructor was a particularly hard grader rather than point to their own inadequacy. In addition to knowing others' grades, it would be important to know how their levels of effort were compared. For example, if one's failing grade was obtained only after maximum effort, while others' similar grades were obtained with minimal output, one might really feel inadequate and perceive the need for help.

The availability of attribution-relevant information depends on communication among students. In the typical class such communication is quite limited, causing students to base decisions of need on data from a small sample. Veridical attributions would improve as this network widened. Since conferencing provides this increase and facilitates various types of disclosure, it is predicted that its adoption will result in more accurate assessments of whether help is needed. Conference voting (or polling) utilities may even aid this process by collating information in ways not otherwise practicable. For example, a poll on the question, "How many of you thought the exam was difficult?"

would provide a pool of information unlikely to be available without computer-mediated networking. If not occurring spontaneously, conference facilitators could suggest polls as a way for students to learn about how well they are performing and whether they need help.

However, an even more powerful dynamic appears to take place in conferencing: the direct admission of need. An examination of recent course conferences using CONFER at the University of Michigan indicated that admissions of inadequacy were ubiquitous. These occurred most often at the beginning of a term with students claiming to be "lost" or "stuck", needing help with conferencing commands. What is for many students a first introduction to timesharing and conferencing seems to elicit an ethic that admissions of inadequacy are to be expected. (This tendency extends to help-seeking itself, as discussed below.) Content analyses would reveal how extensive are such admissions and to what they refer. We might ask, for example, whether early admissions of need related to learning the system and conferencing make it more likely that students will admit need later on in substantive areas?

Assume now that a student believes that help is needed. The question then is whether to seek it. Models of help-seeking have case this dilemma in a decision framework in which persons weigh the benefits and costs of seeking and not seeking assistance (Gross & McMullen, 1983). These are now outlined, followed by an examination of the potential influences of conferencing on help-seeking decisions.

The most obvious positive outcome of having sought help is the increased likelihood of task accomplishment (predicated of course on having received quality help). Students who see their instructors, go to study skills personnel, or ask other students for assistance, are more likely to achieve their academic goals than those who fail to do so. Seeking help may also lead to the perception by others that one is motivated to perform and/or interested in accomplishment. A most familiar manifestation of this is asking questions in class. Except when carried to excess, there is evidence that this is responded to by teachers with favor (Nelson-LeGall, Gumerman, & Scott-Jones, 1981).

In addition to more immediate goal accomplishment, by seeking help one may acquire general skills that decrease the necessity of future help-seeking. That is, one may learn approaches to problems that transfer to other situations. Further more, it is possible to consider help-seeking as a useful skill in itself. We typically think of learning strategies in purely cognitive terms, such as acquiring mnemonic techniques for better memory (or e.g., the familiar SQ3R study method). Obtaining help can be included in this category of techniques or strategies. By going through the process, from the first step of recognizing the need for help to the final one of assessing the helping resources available, one gains valuable learning skills.

The several negative consequences of help-seeking have been subsumed under a single principle: threat to self-esteem (Fisher, et al., 1982). According to this notion, having to seek help is inhibited to the extent that it evokes feelings of inferiority.

The perception by individuals that they are seeking help may be threatening to the extent it is viewed as a sign of personal inadequacy (see above). Western socialization contributes mightily to this perception with its stress on individual accomplishment and self-reliance (e.g. Merton, 1968). Threat also arises to the extent that seeking help is perceived to constitute a social stigma. The term that describes such public threat is "embarrassment" (Shapiro, 1983). Many studies implicate potential embarrassment as a major factor in reducing help-seeking. Accordingly, help-seeking will be inhibited to the extent that it is public, or facilitated when permitted in relative confidentiality (Karabenick & Knapp, in press).

When persons receive help they may feel indebted to the helper and, given the "norm of reciprocity," feel obligated to repay the favor (e.g., Gross, et al., 1979). The strength of this feeling depends on may factors, including the nature of the helping relationship, such as whether it is formal or informal, and/or whether it is based on exchange or is communal in nature (cf. Clark, 1983). Studies indicate that, under certain conditions, persons are less likely to seek help when they are unable to reciprocate and would thus remain in a state of indebtedness (Morris & Rosen, 1973).

Both personal and situational characteristics determine whether, in any given instance, positive or negative consequences are more salient. Fisher, et al., (1982) pose the issue in terms of the relative degree to which aid is perceived as "self-supportive" or "self-threatening." For example, highly competitive situations that stress cultural values of self-reliance and "rugged individualism" would be highly threatening and inhibit help- seeking. Conditions relatively lower in competition (or, higher in cooperative norms), that are more permissive with regard to adherence to individualistic cultural values would facilitate aid requests. For the present discussion we would be interested in the moderating influence of computer conferencing environments on the salience of supportive vs. threatening elements.

Conferencing and the decision to seek help

An examination of course conferences using CONFER (noted earlier) not only revealed frequent admissions of the need for help but a high frequency of help-seeking behavior as well. In fact a free text search string of "help" caused a hit in almost every item in one course conference. Much of it centered around learning the system at the beginning, then shifted to substantive areas. Although comparisons with non-conference inter-student and student-faculty interactions are not available, it is unlikely that a comparable rate of help-seeking would occur in that context. What are the characteristics of conferencing that might have produced this high rate?

Anonymity. From what is known about the determinants of help- seeking, course conferencing appears to decrease its perceived negative consequences. In cases where anonymity (e.g. using pen names) is permitted the reason is obviously the reduction in social stigma, or embarrassment Nadler & Porat, 1978; Shapiro, 1983), especially when faculty have access to the conference. And this would be more true for students who have great difficulty with public admissions of inadequacy (Karabenick & Knapp, 1986; Nadler, 1983).

Awareness of help-seeking and cooperative norms. Since help- seeking in conferences becomes public information (whether or not anonymous) students are more likely to become aware of other students' needs for assistance. This makes admitting one's own plight less unique, less conspicuous, less painful, and therefore more probable. In a sense, help-seeking can become normative. Furthermore, from their outset, class conferences tend to establish a norm of cooperation rather than competition. There is the sense that students are joining together in a shared experience (although this certainly is not inevitable in all conferences - cf. Stevens, 1981). The act of asking for help is a part of that experience during early interactions, and group dynamic forces can operate on participants to conform to those expectations (Cook & Flay, 1978). Thus, in cybernetic fashion, early requests for help would encourage their continuation.

Less need to reciprocate. The nature of conferencing should also reduce requirements for reciprocity. That is, it is not as necessary for an individual who receives help to repay the favor since there are others who could provide it. In terms of "social impact theory" (Latane, 1981) there is division of impact. Even further, conferencing often gives participants the opportunity to demonstrate what they know. It's almost a contest to see who can provide the best answer or the right information in response to a request. In that atmosphere reciprocation is much less a factor since giving help is actually a net benefit to the helper. And if conference participants perceive their relationships in "communal" rather than an "exchange" terms (Clark, 1983), then as noted earlier, reciprocation would not be expected. In general, asking for help would not incur the indebtedness that is frequently present in non-conferencing student helping interactions (Gross, et al., 1979; Morris & Rosen, 1973).

Group help-seeking. A common occurrence in courses is that groups of students are more willing to approach their instructor than are individuals. The richer communication network of conferencing increases the likelihood that this will occur. First, the more frequent contact among students makes it more likely that common needs will be identified (especially if voting or polling were used). Then too, students would find it easier (lower perceived negative consequences) given such a consensus to approach their instructors than would be the case if they perceived themselves acting alone.

Features of instructor-student conferences

Thus far we have concentrated on course conferences in which students discuss course issues with or without instructor access. What about help-seeking by individual students in private conferences? In many respects the effects of course conferencing would apply here as well. However, there are features of computer conferences that can facilitate a variety of beneficial instructor-student interactions, including necessary help- seeking. Many students are intimidated by faculty members and have difficulty approaching them. The computer interface itself would be predicted to make it more likely they would do so. This would be expected from social impact theory which, in part, predicts decreased avoidance with greater interpersonal distance between persons (Latane, 1981). In other words, at the outset, faculty should be more approachable.

One feature of computer mediation and conferencing is the relative absence of time pressure. Based on personal observation, one reason that students do not come to instructors for help is performance anxiety. What they often fear is that their helping interaction will become a testing situation in which they will be asked to perform. Not only not knowing the answer but hesitating is something students want to avoid. Since in mediated communications students are not time-pressured, performance anxiety can also be reduced due to pre-transmission editing. Since, students have the luxury of asking questions and of composing responses in their own time frame there should be less fear of "making a mistake" and displaying their ignorance. This is a decided advantage over voice communications (or even teleconferencing) since in that context time pressure exists even without face-to-face contact.

A feature of conferencing that may inhibit help-seeking is that conferences are permanent records of interactions. Even when help-seeking is not only tolerated but normative, students may not wish to make what in their estimation are excessive demands, even when they are not in some objective sense excessive. While in everyday discourse earlier requests may be forgotten, a review of a conference could reveal a pattern of help-seeking that might be perceived as indicating dependency or inadequacy. Students who review their own conference interactions and conclude that they have made too many requests might be too embarrassed to ask another question even if they desperately need additional help.

Acquiring needed assistance

Actually seeking help is the final stage in the process. Computer based communications and conferencing are of course particularly facilitative at this point. Whether it is seeking specific course-related assistance from other students or one's instructor or seeking assistance from university support personnel to improve general study skills, access is vastly improved. First, there are many more informal sources, primarily other students, on-line than without conferencing, and with these greater numbers an increased likelihood that appropriate help will be forthcoming. Second, it is easier to access help without the time and physical constraints necessary for face-to-face contact. But these advantages are well known.

Perhaps less well appreciated is a more subtle dynamic. For a variety of psychological reasons, such as principles of cognitive dissonance (Festinger, 1957) and self-perception theory (Bem, 1972), people often undertake undesirable or effortful actions by an incremental process. That is, more costly behaviour is more likely if preceded by one less costly, sometimes this principle, getting people to take the first step toward the eventual goal, however small, is extremely important. The ease of access that computer-based communication provides may make it more likely that students will, in fact, take that first step. For reasons noted above (e.g., performance anxiety) students might find it easier to initiate contact through a computer interface than verbally by telephone. It might also be possible to explore problems (why help is needed) in this way since one can take one's time in responding to formulate and to edit one's responses. Having acted, however minimally, further

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help-seeking becomes easier. Unless people perceive themselves as forced to act, their self-concept can change (I am a person who gets help when needed.), and they may subsequently have more positive attitudes toward seeking additional assistance when needed, setting the stage for accessing more extensive assistance.

The importance of cooperation

It is important to reiterate that the potential advantages of conferencing presume a supportive environment. As noted earlier, a cooperative climate tends to exist in course conferences, but course incentive systems (e.g., grading procedures) that create high levels of competition could suppress cooperation and the incidence of helping activities. By their neglect of, or hostility to, requests for help, instructors can have a similar influence. Communicating, for example, that seeking help betrays a student's ignorance or lack of initiative could eliminate that behavior, especially in conferences to which that instructor has access. There is no guarantee, of course, that conference participants (i.e., other students) might not communicate similar attitudes toward help-seeking. This could be prevented by judicial comments of instructors or other conference organizers.

Help-seeking and individualism - balance

It is important to stress that while computer-based communication systems make help-seeking easier, it is not suggested that other people are always to be used as a substitute for individual initiative. Stevens (1986) notes the utility of an information- seeking strategy which suggests that when you need some information, first ask somebody who knows, then somebody who knows somebody who knows, and when all else fails, look it up. This may be efficient in some contexts (such as inquiry networking), but in environments where learners are supposedly acquiring higher level skills, that approach may be, in the long term, counter-productive. In academic contexts what is called for is "instrumental help-seeking" (Nelson-LeGall, 1983). In this form of help-seeking learners ask only for the amount of help necessary to further development of their skills (e.g., a few clues on the basic principles of sorting algorithms), rather than help just to make the learner's life easier (e.g., a complete shell or bubble sorting program). As in non-conferencing environments it's a matter of balance. It is important that students be able to overcome obstacles to effective help-seeking without using it to their long-term detriment.

In sum, we began with the proposition that seeking needed academic assistance is valuable and have suggested some ways that conferencing might influence that behavior. In general, it appears that conferencing would act to facilitate help-seeking. However, it is recognized that much of this analysis is quite speculative and awaits empirical evaluation.

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A Model of Individual Adjustment Process to Computers.

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ABSTRACT

Individual adjustment to new technology is largely dependant on one's ability to change working habits in accordance with the new production tools. A global approach combining Bandura's behavior modification model with attitudes and personality traits measurement is proposed to understand the dynamics of the change. A preliminary study was performed with 72 subjects to test the relevance of the approach in a setting in which students have to learn micro-computer use. A descriptive analysis based on correlationnal measures shows: 1) a generalized independance between behavior and attitude variables, 2) an interesting factor-like grouping around behavior related and attitude "factors", and 3) influence of a "compulsory use" context which seems to favor integration of behavior, attitudes and traits.

Tasks computerization in the workplace will necessarily modify the way members of an organization relate to their tasks. Various operators will have to change their working habits to adapt to the computerized operating mode. In fact, people will have to learn new behaviors to perform tasks that remain overall unchanged. As Zuboff (1982) puts it: "New forms of technology inevitably change the way people are mobilized to work as well as the kinds of skills and behavior that are critical for productivity". And more precisely concerning office systems, Szlichcinski (1983) says: "...office automation systems require [ ] complex interaction between the user and the system, and in the case of office automation systems, play a [ ] pervasive role in the user's work. In these circumstances substancial changes in behaviour patterns occur quite quickly [ ] as users adapt to a system and learn to exploit its capabilities." Thus, success of computerization in the workplace appears to depend upon users capacity to adapt individually to this change; an adapted user being one who can perform efficiently, whith the new available tools, old and new tasks required by his organizational needs and functions. From this point of view, the behavior modification process is crucial in order to understand individual adjustment to a new environment.

Unfortunately, even though there is an agreement about the necessity of individual adjustment as a condition for efficiency in working with computers (Dillon, 1983; Szlichinski, 1985; Zuboff, 1982), factors implied in this process and their relationships remain to be identified. Indeed, even when including short articles centered on formation programs (Barrow & Karris, 1985; Bloom, 1985; Brod, 1982), behavior modification models are almost inexistant in the individual adjustment literature. Other conceptual contexts related to individual differences or attitudes were preferred to behavior modification frameworks as means to understand, help and sometimes predict individual use of computer. One could then ask if behavior modification models are relevant to the computer domain. The present paper is an attempt to apply such an approach to the computer use domain.

Recent behavior modification models showed self-referent thoughts as mediators in the behavior modification process associated with individual adaptation (Abramson, Seligman and Teasdale, 1978, Mahoney, 1974; Meichenbaum, 1977). Bandura's model (1977, -82, -86), currently one of the most prevalent models, represents individual adjustment to a new environment as the organization of one's cognitive and social skills into relevant actions. In that model, two independant factors are responsible for behavior modification: self-efficacy perception and outcome expectation. "Perceived self-efficacy is a judgment of one's capability to accomplish a certain level of performance, whereas an outcome expectation is a judgment of the likely consequence such a behavior will produce (Bandura, 1986)."

Self-efficacy

Bandura (1977, -82, -86) has been interested more specifically in peoples' evaluations of their capacity to perform the different actions required to adjust to new situations. Self-efficacy perception, as Bandura calls these evaluations, influences one's propensity to enter actions, to persist in these actions and consequently, to succeed; as long as necessary personal skills and appropriate incentive are not missing (Bandura, 1982,86). It has often been demonstrated that self-efficacy perception can predict behavior modification as well as previous behavior (Bandura, 1977, 78). In Bandura's view, self-efficacy perception is usually measured by asking someone his own evaluation of his capacity to perform a specific task. To do so, tasks are proposed in a growing difficulty order to people who rate their confidence to perform these tasks on scales ranging from 10 to 100. These scales can provide two kinds of information. As a dichotomic scale, when using a cutoff point, they give a measure for self efficacy perception. Bandura (1980) also proposes to use of the whole range of the scale as a measure of self- efficacy perception strength. This strengh or one's confidence in his or her efficacy evaluation, influences persistence to behave when facing difficulties and/or failures. Moreau & Rousseau (1986) developped a self-efficacy scale toward computers that respect these theoretical pre-requisites and successfully tested it. But in spite of these few efforts, self-efficacy remains too new a research variable in the computer domain to be associated to an abundant empirical literature.

Concerning individual adjustment to computers, one can find notions similar to Bandura's self-efficacy in recent works. Veer et al. (1985) consider Dorner's "perception of own competence" to be associated to successful learning in the computer domain. That perception would play a major role in the development by the user of a mental model of the computer, which is likely to facilitate adjustment. Anderson et al. (1981) developped a computer literacy scale. The scale included a measure of self-efficacy, that is in their view: "the extent to which a person feels confident about his or her ability to deal with computers". Anderson et al. (1981) used their literacy scale to compare children exposed to a computer assisted instruction (CAI) program with non-exposed children. Self-efficacy was shown to develop through time (ps.01) and to be higher in the exposed group (ps.05). Self-efficacy was also sensitive to a "system malfunction treatment" and revealed a difference between the groups (ps.05). "Those students encountering a malfunction were less likely than other students to increase their sense of computer self-efficacy as a consequence of their CAI experience. The difference between those encountering a malfunction and those lacking such a treatment was substancial with respect to their sense of efficacy, and this effect persisted afterward, at least until the six month follow-up testing."

Anderson et al. (1981) obtained interesting results with their self-efficacy scale. Meanwhile, the way they interpret the construct does not fit in a behavior modification model. Indeed, Anderson et al. (1981) propose a two factor attitude model with a cognitive and an affective factor. Steele et al.(1983) demonstrated empirically with fifth grade students the validity of Anderson's model stucture. Meanwhile, according to Anderson et al. (1981), self-efficacy is a constituant of the affective factor. This does not correspond to Bandura's self-efficacy construct which proceeds of both cognitive and affective dimensions. According to Bandura (1977, -82, -86), self efficacy perception is a mediator between knowledge and action. An attitude model does not provide this theoretical proximity with one's action that can be found in a behavior modification model.

To build on Bandura's model of behavior modification means that one has to consider environmental factors and mostly, contact with the object of change. Self-efficacy perception develops through enactive training (Bandura, 1977, -82, -86), that is through one's direct experience with the object. Since self-efficacy is closely related to behavior, contact should also show a similar relationship. One can find interesting results in works concerned with change in people's behavior related to computer domain. Studies in local network and tele-conferencing show that experience and familiarity with computers are related to use. In longitudinal studies, Hiltz and Turoff (1981) remarked that behavior changed with respect to experience; length of the average session increased with gains in experience and pattern of utilization appeared to be a fonction of time on line. Galletta (1986) compared variables such as experience, satisfactions and attitudes and found the former to be the best predictor of actual use.

Attitudes and outcome expectation

A basic difficulty with Bandura's model is that it does not make room for the concept of attitude. On the other hand, studies about adjustment to computerization make abundant use of the attitude towards computer to gain some understanding on the adjustment process and the success of computerization. Actually, attitude is often thought to be crucial for the individual adjustment in the computerized environment (Lucas, 1981; Shultz and Slevin, 1975; Christie, 1981). In general, attitudes concern a value judgement about an issue or an entity. They can inform us about the way people judge a situation or changes in a situation as being more or less positive or negative among other characteristics. Attitudes have been widely related to usage in the computer world. Should it be with computers (Guimond et al., 1985; Kerber, 1982; Rafaeli, 1986; Zoltan & Chapanis, 1982) or with text editor system (Arndt et al., 1983; Roy, 1983). Moreover, Rice and Case (1983) present results confirming that "people who tend to become heavy users of computer based communication have strong feelings about the benefits of such systems early on, and that continued used over time does not alter these feelings." In the same way, the amount of use of a system appears to be related significantly to users' appreciation of an increase in the number of its features (Hiltz and Turoff, 1981).

Attitude has been a major variable in numerous works on individual adjustment to computer. Unfortunately, such a favour did not provide a theoretical model that would help to organise all the results. Recently, Rafaeli (1986) proposed a model that attempts to comprehend the different factorial structures identi- fied until now in the field. According to Rafaeli (1986), the literature invites to consider as independant positive and negative attitudes toward computers. Also interested in the attitude-usage dynamic, Rafaeli (1986) found a relationship between positive attitude and use but could not find explanations concerning negative attitudes. She suggested then the presence of moderators, among which self-efficacy, to explain the attitude-usage dynamic. A behavior modification model could thus be more satisfying than the available attitude-centered models not only to explain behavior but may be, also other already observed dynamics.

Unfortunately, Bandura does not grant much weight to attitude in his model. Nevertheless, he reports Collins' results showing that children who perceive theirselves more efficient in mathematics also display more positive attitude toward mathematics (Bandura, 1986). This suggests to consider attitude measures in relation with self-efficacy somewhat on the line of Rafaeli. Attitude measurements are classical means to study individual adjustment to computerization, it is consequently important to establish their relationship with a behavior modification approach. Consequently, one of the aims of this paper will be to observe the relationship between self-efficacy, outcome expectation and attitude.

Bandura's model can also relate to attitude by the outcome expectation factor. Outcome expectation are different from the usual attitude in as much as they are value judgements made by people about consequences of changes in their own behavior. They are much more behavior oriented than attitudes, and consequently play a determinant role in Bandura's model while attitude are hardly considered. Shultz and Slevin (1975) remarked that MBA students' attitude toward an office network was primarily related to the personal gains they expected from it. Thus, outcome expectation could also be related to attitude and therefore, to computer use.

Individual differences and personality traits

Individual differences refer to the relative position of individuals on some measurement scale about a psychological variable. The position on a scale is commonly related to one's performance on a task or to a relevant cognitive dimension for personality. These variables are part of what could be called an important research field in psychology: personality traits. Traits form a group of variables important in computer adjustment. Indeed, personality traits once appeared as crucial measures for adaptation and design (Zmud, 1979). They present advantages such as stability in time and environment, and resistance to change. These are important advantages when comes the time to evaluate individual needs in a computerized setting. In this paper two personality traits will be considered: anxiety and locus of control. Anxiety and locus of control are two personality traits which appear to bear some importance in both self-efficacy model and user adjustment process to computers.

Self-referent thoughts are supposed to be crucial in one's management of his or her anxiety. According to Bandura (1982, 86), the more efficient one feels in a particular situation or anticipating this situation, the less anxious he or she will be. In the computer domain, anxiety have been reknown as an important personality trait related to adjustment (c.f. Zmud, 1979) and was the central point in recent text on formation and adjustment (Barrow & Karris, 1985; Bloom, 1985; Brod, 1982). Moreover, Anderson et al.(1981) observed a decrease in anxiety for students who were taught with computers and also, a difference between these students and those who did not received computerized instruction. Moreover, a six month follow up revealed that "students who spent only fifteen to twenty minutes with the microcomputer- delivered [ ] lesson were less anxious about computers and more confident of their own computer capacity than students who did not have any time with the brief [ ] lesson on the microcomputer" (Anderson et al., 1981).

Locus of control is a personality trait developed especially by Rotter in his generalized expectancy theory (1966a). This theory attempts to explain how behavior is influenced by individual differences in the tendency to perceive events as being either personally or externally determined (Rotter, 1966a, -66b). Locus of control refers to people's tendency to interpret events as contingent to their own action (internal locus of control) or as ramdomly governed (external locus of control). According to Bandura (1986), theories "concerning the controllability of outcomes bear some likeliness to the notion of perceived self-efficacy" in that "in general, people who believe their outcomes are determined by their behavior tend to be more active than those who perceive events more fatalistically." Finaly, Moreau & Rousseau (1986) and Sherer et al. (1982) used locus of control as a convergeant validity measure for their self-efficacy scale.

Locus of control relates to computer domain by the means of attitude. Coovert & Goldstein (1980) found correlation between internality and positive attitude toward computers. Moreover, outcome expectation factor in Bandura's model suggest to take note of how peoples interpret the environment's responses to their actions.

Goals and hypotheses.

The present paper presents the result of a preliminary study performed with university students involved in some form of training with micro-computer work. It is part of a research program aiming to describe and explain individual adjustment to computer through a behavior modification theoretical model. Study of individual adjustment process to computer use based on a behavior modification model presents major advantages. First, it enables new behavior related measures (self-efficacy and outcome expectation) that have been rarely used, and that are linked to a well developped conceptual model. Self-efficacy perception and outcome expectation are considered as central aspects in this model. They are thought to be major determinants in worker's determination to use computer and also in their effectiveness.

Secondly, the model allows theoretical and empirical integration of previous results obtained in the field with other important variables. Individual variables considered to be useful to bring relevant information on individual adjustment are attitudes and personality traits. These variables should be related to self-efficacy development that takes place along with knowledge acquisition about computers. However, a behavior modification model makes it necessary to consider environmental and situational constraints in which users are to work. In general it requires the study of the influence of situational variables, like accessibility and availability of non-computers means to perform a task, on self-efficacy perception development.

So, this project aims to identify interaction patterns among three groups of individual variables:

1- behavior task-oriented variables,
2- evaluative judgement, and
3- general personality traits.

Their interactions will be studied in two different settings in order to evaluate the effects of situational variables related to miscelaneous environment work and users.

A further benefits stemming from a behavior modification approach is the behavior changes overtime. Adaptation is a process which occurs over a period of time and its study implies the use of repeated measures. For this reason, the design of the present research is a longitudinal one. This procedure should permit to see if the individual variables interact or are influenced by situational variables. Moreover, to insure as mush strenght as possible to the results, the research was conducted in two different computer learning settings.

Individual variables in this case will be, self-efficacy perception, outcome expectation, attitude toward working with computers, subjective familiarity with computers, and two personality measures, anxiety and locus of control. Situational variables are training and compulsory use.

METHOD

Experimentation

The subjects in this research were recruited on a voluntary basis from two undergraduate courses at "Universit Laval". Seventy two (72) students participated in the research and doing so, were eligible to a sweepstake with three $100.00 prizes. 26 were registered in a "micro computing initiation" class and 46 in an "applied statistics" one. While micro computer use was compulsory for the first group of students, those involved in statistics had the choice to use or not to use PCs to complete homeworks while receiving an introduction to computing and statistics programs.

Subjects had to fill questionnaires and psychological tests on two different times during the semester. Time I took place at the beginning of the term before any contact with computers and time II after the last regular class. At time I, subjects completed personality tests (Locus of control and Anxiety Inventory), three research questionnaires (Self-efficacy Perception, Expected Outcomes and Attitudes), and personal information questions. At time II, they only completed the research questionnaires and some questions about their use of computers all along the semester.

Scales and questionnaires

The Self-Efficacy Perception Questionnaire.
A person SEP is usually measured by asking his own evaluation of his capacity to perform on a specific task. SEP is always considered in relation to a specific situation or a specific task. Thus, the questionnaire proposes eleven (11) sub-tasks in a growing difficulty order. Subjects rate their confidence degree on 11 points scales ranging from zero to 100.

Outcome Expectation Questionnaire.
This twelve (12) items questionnaire provides information about subjective evaluation of personal outcomes related to computers usage and knowledge. Seven items are original ones while the other

five (no. 2, 3, 4, 7, 8) are from Shultz and Slevin(1985) attitude scale. Items are answered on a Likert type scale ranging from 1 to 5.

Attitude scale.
Attitude toward working with computers were measured with a translation of Rafaeli's (1986) attitude scale. This scale counts nine (9) items that are answered on seven (7) points Likert type scale.

Personality variables.
Anxiety was measured with the Bergeron's (1980) Trait anxiety scale adaptation of Spielberger et al. (1970) "State Trait Anxiety Inventory". Locus of control was measured with an adaptation of Rotter's (1966b) questionnaire.

General information.
Informations such as previous experience with computers, familiarity with computers, time on-line for course requirements and time on line for other reasons were gathered with a questionnaire.

Analysis

All computations and analysis were performed with the SAS Basics (1985) and Statistics (1985) Packages. The alpha level accepted to reject the null hypothesis has been fixed for all the analysis at .05.

RESULTS

Results presented here are based on a correlationnal analysis that we consider more appropriate given the exploratory nature of the study. Pearson "r"s were computed to identify correlations between relevant variables. Results are presented in Table 1 and Table 2 as correlation maps for each group at both time I and time II. Table 1 shows that both groups at time I are quite similar. Relationships between contact (previous experience), familiarity and self-efficacy are consistent whatever the setting. None of these three variables correlates with outcome expectation or attitude measures. Meanwhile, these latter variables are systematically related to each other much in the same way as are the three former variables. Thus, two main variable sets appear as independant "factors" in the model. Excepting for the correlations strenght, personality measures are the only way to differenciate the two settings. Anxiety in group1 correlates with self-efficacy, while it correlates, as does locus of control, with attitude in group 2. Interestingly, self-efficacy and attitude are not associated with the same variables set as defined by preceeding results.

Table 1.Cross-correlations (Pearson's r) between variables for group 1 (n=26) and group 2 (n=46) at time I.

	group 1							group 2						
	Eff	Ctc	Fam	Exp	Att	LoC	Anx	Eff	CtC	Fam	Exp	Att	LoC	Anx
self-efficacy														
contact (experience)	.40							.32						
familiarity	.68	.58						.41	.81					
outcome expectancy	.07	-.01	.15					.10	-.22	-.16				
attitude	.34	.35	.25	.41				.07	.18	-.03	.60			
locus of control	-.15	-.04	.13	.07	-.24			-.18	-.11	-.06	-.23	-.33		
anxiety	-.61	-.09	-.24	-.03	-.13	.22		-.24	-.12	-.07	-.06	-.37	.42	

(group 1): ps.05 for "r"s r.40
(group 2): ps.05 fpr "r"s r.32

Table 2. Cross-correlations (Pearson's r) between variables for group 1 (n=46) and group 2 (n=26) at time II.

	group 1								group 2						
	Eff	CtC	CtP	Fam	Exp	Att	LoC	Anx	Eff	CtP	Fam	Exp	Att	LoC	Anx
self-efficacy															
contact (C) (compulsory)	.31								XXX	XXX					
contact (P) (personal)	.10	.48							.62						
familiarity	.60	.70	.37						.70	.32					
outcome expectancy	-.06	.29	.11	.44					.16	.27	.06				
attitude	.28	.32	.05	.58	.62				.00	.16	.06	.59			
locus of control	-.07	-.01	.07	-.09	.44	-.36			.03	-.03	.22	-.32	-.33		
anxit	-.52	-.10	-.02	-.37	-.14	-.52	.22		-.17	.04	.06	-.14	-.09	.42	

(group 1): ps.05 for "r"s r.40
(group 2): ps.05 fpr "r"s r.32

Table 2 shows important differences and similarities with table 1. Almost no change occurs in group 2, that is the correlation map still shows the same correlation patterns between variables. The "behavior triangle" remains the same as does the "attitudinal diad". The relationship between anxiety an attitude dissapears but locus of control now correlates both with attitude and expectation. The most dramatic changes occur in group 1. The clear cut independence between attitude and behavior has dissapeared as outcome expectation and attitude now correlate with familiarity. Familiarity is also related to self-efficacy and contact (compulsory). Unfortunately, no relationship is observed between self-efficacy and contact. Anxiety has extended its link with other variables showing not only relationship with self-efficacy but also with attitude.

Table 3 shows Pearson "r"s between variables measured at time I and at time II. These results provide cues about the predictor role of certain variables and their importance in the adjustment process. In group 1, previous experience at time I does not affect any variable at time II, not even behavioral variables. Meanwhile, the only behavior variable that correlates with usage is familiarity. Moreover, attitude and expectation apppear to be better predictors than self-efficacy and previous experience. Group 2 presents a quite different dynamic. All behavioral variables at time I are related to the behavioral variables at time II. Thus, this group of three variables appear as a good predictor of use with familiarity on top, followed by previous contact and self-efficacy. Similarly, attitude and expectation correlate with each other across time passage. But the independance between behavior and attitude remains clearly defined. There are no interinfluence in any way between attitude and behavior in that group.

Table 3. Cross-correlations (Pearson's r) between variables at time I and time II for group 1 (n=26) and group 2 (n=46).

Time II	group 1						group 2				
Time I	Eff	CtC	CtP	Fam	Exp	Att	Eff	CtP	Fam	Exp	Att
self-efficacy	.60	.28	.01	.50	.01	.37	.59	.30	.29	.06	-.05
contact (experience)	.13	.15	.03	.21	.12	.17	.55	.36	.51	.04	.03
familiarity	.38	.55	.19	.43	.06	.17	.62	.47	.65	.06	.01
outcome expectancy	-.10	.36	.47	.11	.23	.27	.16	.27	.06	.57	.48
attitude	.28	.29	.53	.46	.21	.49	.07	.18	.04	.48	.52

(group 1): ps.05 for "r"s r.39
(group 2): ps.05 fpr "r"s r.32

DISCUSSION

The number of subjects and the exploratory nature of this research prompt to cautiousness in discussion. Meanwhile, some results appear with enough clarity to be seriously considered.

First, one can look at the stuctural aspect, that is the correlation structures for both groups at specific times. On one hand, three variables are systema- ticaly related to each other at both stages of the experiment. These variables, self-efficacy, contact and familiarity, form what we could call the behavioral set. Familiarity, which is an important dimension for the self- efficacy concept, seems to be the most active variable for the structuration of the behavioral set. On the other hand, there is a consistant correlation between attitude and outcome expectation and these two variables form an attitudinal set.

Moreover, there is almost no relationship between the two variable sets. The only correlation appears in group 1 at time II (see Table 2), between aoutcome expectation and attitude on one hand and familiarity on the other. Surprisingly, outcome expectation is not related to contact and nor does attitude. This result confirm Bandura's assumption of independance between self-efficacy and outcome expectation, but it also moves away attitude from self-efficacy and contact. Thus, the mediator role of self-efficacy in the attitude-usage dynamic is not supported by the present data. Meanwhile, the constant-like relationship between expectation and attitude observed in this study replicates previous results (Shultz and Slevin, 1975). Moreover, Ajzen and Fishbein (1980) attitude model proposes peoples' outcome evaluations as a part of attitude. The data support such a relationship and invite to consider Ajzen and Fishbein model in future exploration of the individual adaptation process.

Another interesting aspect is the model's response to time passage and situational differences. The correlation matices are essentially the same for both groups at time I as far as behavior and attitude dimensions are concerned. At time II, the picture for group two (free usage) does not change while group one (compulsory usage) shows important modifications. Thus, systematic learning and compulsory use seem to be involved in the linkage between the two variable sets. It may be that an important exposition to computer lead to a reevaluation of beliefs that results in a more integrated and personalized perception of computers. In the present work, the attitude-usage and the expectation-usage relationship appear to be mediated by the familiarity concept.

Personality measures did not correlate with other variables in the same way for both groups. Anxiety correlates more often with self-efficacy in group 1 than it does in group two. According to Bandura, self-efficacy helps people to manage anxiety. Though, this may be the case in group one where pressure for usage is much higher than in group two. Interestingly, anxiety is also related to attitude at time II for this group. This relations pathway (anxiety <-> self-efficacy <-> familiarity <-> attitude <-> anxiety) can show that self-efficacy which help anxiety management develops with familiarity, which lead to attitude reevaluation, thus moderating anxiety level. However, one has to remember that results remain on a correlational basis and understand this interpretation as speculative.

Anxiety in group two is quite less important than in group one. Meanwhile, locus of control which is totally ignored in group one have to be considered for group two. Locus of control does not relate to the behavioral set and correlates only with outcome expectation or attitude. This suggests that behavioral and attitudinal aspects remain perfectly distinct in this group. Moreover, peoples' most stable and global characteristics, such as personality traits, influence only the beliefs dimension.

Now turning to the prediction value of the model's variables, the most deceiving result comes from self-efficacy; it is not related as it was expected to usage. Indeed, self-efficacy is not related in any way to contact in group one and is related, but with less weight than other behavioral variables in group two. Meanwhile, familiarity, which is a behavioral variable, appears to be the most important predictor of use for both groups. Interestingly, attitude and outcome expectation are correlated with use for group one and confirm therefore empirical results found in literature. But in group two, there are still no relationship between attitudinal and behavioral sets, showing for this group a clear distinction in the span of influence of each set. In this group, variables in each set are entangled, but the sets are perfectly independant. It appears as if contact produces a perception that concern the whole individual and which is integrated more clearly and without that contact, evaluations people make of computers remain far from their personal engagement.

CONCLUSION

The basic aim of the present study was to implement a behavior modification approach into the context of adaptation to micro-computers. Secondary to that was the evaluation of the relationship between attitudes, self-efficacy and outcome expectancy.

The data clearly support an approach which takes into account two sets of factors: attitudes and competence. Bandura's model, as tested here, does not prove to be adequate to describe the dynamics underlying adaptation to computer use. While the expected independance between self-efficacy and expected outcome has been observed, the lack of correlation between self-efficacy and number of hours of contact with computers and the systematic link between outcome expectancy and attitudes is not supportive of the model.

Nevertheless, we do consider that the study of the development of self-efficacy is worth pursuing in a broader sense. Associated with attitudes measurement and taking into account training conditions, it could provide a dynamic picture of the evolution of an individual within the context of micro-computer training. Moreover, further work will be needed, very likely on the line of Dorner and Veer et al. (1985) to develop more adequate measures of the perception of self-efficacy.

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If Computer Users are a Community, the Conference Must be the Town Meeting

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ABSTRACT

How well the facilities provided by a computer are used, and how productive the users are able to be, depends largely on how users are prepared to cooperate with one another. This in turn depends largely on how well the computing community functions. If users feel able to work together confidently as part of a responsible and responsive user community, they can support and help each other deal with computing problems, which will increase their productivity and the satisfaction they can get from their work. On the other hand, if users are isolated and hostile to one another, they are hardly likely to exchange information or work on problems together. Also, they will have less reason to respect the system or each other's right to access it.

In the past, users generally communicated with each other face to face. Today, with the emphasis on interactive computing, users often exchange electronic messages more frequently than they talk with one another, and computer conferencing facilities make it possible for users who have never met to exchange views. These conferencing and messaging facilities are helping to determine how the computing community works.

In this paper, I intend to investigate the relationship between users' behaviour and the social environment of which they consider themselves a part. I will look for ways in which communication between users affects their sense of belonging to a community of users, and the way specific features of the conferencing and messaging systems at Queen's University make certain kinds of communication easier or more difficult.

I am using three approaches. The first is an analysis of the responses to a survey of user attitudes that was provided as part of the Queen's conferencing system. The second is interviewing members of the Queen's community who use the computer and the conferencing facilities, and also some users who do not take part in the computer conferences. I am also analysing the actual discussions that have taken place, to find out what people are saying about the system and their place in it.

I hope to analyse the effect of both local user groups and of the growing international networks. Is an international computing community growing up, similar to the local user communities but much vaster? If so, what effect can we expect this to have in the future? Obviously, international networking will have an enormous effect on the exchange of information between people; what kind of community, if any, is this likely to foster? To answer this question, I will be distributing a questionnaire, similar to the one I used at Queen's, to various universities on BITNET, with questions about use of the network.

I believe that the user community affects individual users in ways that are worth studying. Even more, I believe that as our computing communities are linked by world wide communication networks, the development of this community presents both dangers and opportunities which we can not afford to ignore.

Preface

Whether they intend to or not, the regular users of a large, shared computer system form a community. They have common interests, if only in keeping the system going, and also common problems. This almost always means that users find themselves talking to one another, even if it is only to curse the system together.

When most large computer systems got their input from card readers and returned it via high speed printers, users met each other frequently in person, when submitting jobs and retrieving their output. Now that most computing is done through on-line terminals, users have the option of talking to one another through the computer. As conferencing systems are developed, people who never meet face to face are able to have arguments, discuss issues, and share problems and solutions. With the growth of international networks, computers have been used for communication between people who live thousands of miles apart, and are unlikely to ever meet. Where once the computer was the subject of discussion, it is in the process of becoming a medium for discussion.

At the same time, the nature of the computing community is changing. In the past, only technicians experienced at programming and using computers ever interacted with them. Thanks to the growing ease of access, computers are fast becoming tools for everyone. The result has been a fundamental shift in the nature of the community of computer users. When it was necessary to have fairly well developed technical skills to deal with a computer, there was a single community of users, with a well defined structure that in practice arranged individuals according to their level of knowledge and skill: those users who knew most about the system, and were most willing and able to answer questions about it had the most prestige. As technical skills become less and less essential for using the computer, and as more and more people actually use the system, the user community has tended to become fragmented. Many different user groups, whose members rarely if ever come in contact with each other, are now using the computer.

In many cases, this fragmentation has brought about undesirable results. From the user's point of view, the fragmentation of the computing community has meant that getting help is more difficult than it was in the past. When the informal user structures that permit users to call on each other for help do not exist, users can be faced with a formidably complex system and nowhere to turn for advice. From the point of view of the administrators responsible for the computer, this means that it becomes their responsibility to provide instruction and advice for all the beginning users of the computer systems, a task they often lack the resources to perform. Another problem for both users and administrators is that without a community of users to be responsible to, some users will behave in a very irresponsible manner. There is, of course, no excuse for behaviour such as deliberately interfering with the work of other users, or the functioning of the computer, but there is often little that can be done by system administrators to deter it short of taking away the offender's access to the computer. In a university environment, where use of the computer may be a course requirement, such an action may be tantamount to expulsion.

Given the problems that the absence of a community of computer users can cause, it makes sense to foster the growth of one, but unfortunately, that is easier to recommend than to accomplish. The development of a sense of community in any circumstance is an uncertain business, and the proper steps to foster it differ according to circumstances. All that can be said with any certainty is that it is easier to develop a community spirit under conditions that foster communication than in circumstances that restrict it. Therefore, computer conferencing and messaging systems have an important role in the development of a computing community.

In this paper, I shall examine some of the effects the state of the user community has had on individual user's attitudes and behaviour. I will be attempting to assess the effect of the use of the conferencing systems we have at Queen's on the attitudes of the people who use them, and the effect these systems have on the community as a whole.

Overview of Computer Communications at Queen's

The need for an effective communications system on a modern computer system has been alluded to in the preface; the sheer size and diversity of the user community means that the title of this paper is true in two senses. While an ideal role of a computer conference is that of the town meeting of a community, the reverse is also the case: if there is to be a community, a conference system must be available, both to serve as the expression of individuals within it, and to allow the members of the community to define its function and collective attitudes.

At Queen's, the recent development of the computer system illustrates these points well. Queen's supports a simple conference system called "Soapbox"* based on the IBM CMS editor XEDIT. Features that users of the system value include the freedom to express themselves without worrying about grades or marks, an authority structure, or censorship. As long as users avoid making personal attacks on one another, or using profanity in the discussions, they can talk about any topic, in any way they choose. Since the system is wide open, very few topics are related directly to computing, and only about half the topics at any one time are "serious", in the sense of attempting to address important political, social, or moral issues. The typical mix of current topics includes two or three discussions about "serious" issues, one or two topics relating to computing and computers, a couple of discussions about sports, and four or five forums for exchanging jokes, riddles, movie reviews, and favorite books.

It is the aspect of exchange between equals that makes the conference the best gauge of the activity and opinions of users on the system. Unlike notices posted by the system administration, there is a sense of give and take between users, and unlike notes exchanged by electronic mail, there is a sense of multi-way discussion. Since anyone can comment on any statement and read or participate in any "Soapbox" discussion, no participant is immune to criticism.

One obvious aspect of this system is that it makes it very easy to make a certain type of contact with other users. It is possible to share ideas with other users, without ever meeting them in person. In practice, this encourages a rather acerbic style of discussion: at a recent face to face meeting with fellow "Soapbox" participants, one of us commented that it would be harder to be sarcastic with other users, now he could put faces to the names and nicknames behind the comments. This particular feature of the system combines discussion with anonymity, since users are identified only by the names they assign themselves, and by their student numbers. The role of anonymity in computer communication is a subject to which I will return later.

The amount of time being devoted to the computer conferences is particularly interesting when the variety of topics, and the completely voluntary nature of the activity is considered. All the users of the conference facility are involved because they choose to be, and all the participants in any given discussion are involved by choice: it is very easy to give up a discussion that becomes abusive or boring. It is quite clear that a good number of people are finding something they want in computer conferences. A pertinent question, however, is this: does the satisfaction that the participants in a conference feel have a positive effect on the larger user group?

Development of the Queen's Communications Systems

To understand the positive and negative effects of the growth of computer based communication at Queen's, it is necessary to understand the background of the development of the computing community generally. From about 1976 to 1981, the mainframe computer at Queen's was a Burroughs B6700. It featured excellent security, and advanced architecture, but its communications facilities were poor, and it was too small to fully satisfy the demand for computing power at

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The names of programs written at Queen's are specified in mixed case, and enclosed in quotation marks. The author of both the conference program "Soapbox" and the similar "Graffiti" is Jim Lesslie of Queen's University Computing and Communications Services.

Queen's, so usage was severely restricted. The most cohesive computing community that existed seldom used the mainframe; instead, they used a series of Digital LSI-11 based micro-computers, which were collectively referred to as the QUICS (Queen's University Interactive Computing Service). These systems were available to any member of the Queen's University community that wished to use them.

The availability of these computers, coupled with the need to exert informal controls over their use, produced a tightly knit community of computer programmers, in which the status of individuals was determined by their programming skill. When this user group was dubbed the "troglodytes" by a computing science professor, they accepted the title, and from then on referred to themselves as the troglodytes, or just the "trogs". This group was able to have a much greater effect on the computing community at Queen's than any comparable group could today. This was partly a tribute to their sheer skill, but it was also partly due to the nature of the community, and also the manner in which information was distributed.

In order to get advice on the use of the computers, it was necessary to ask for it either from a computing centre representative, or from another member of the community. Since all members of the community who had any technical expertise also had a stake in preventing mischief, it was easy for them to moderate the behaviour of other users, particularly those entering the system. Users who were making trouble were cut off from assistance with their work. Since many of the useful programs in existence at Queen's had been written by one of these technically proficient users, it was necessary for any user who wanted to use this software to conform to the informal rules of conduct that had been set up. In addition, the small number of terminal rooms available made it difficult for delinquent users to work without meeting other users whose work they had disrupted. While it would not be possible or desirable to return to the conditions that produced these informal controls, an analysis of the methods they used to enforce a set of reasonable standards of conduct on the computers may suggest some ways the computing community can police itself today.

For a variety of reasons, Queen's converted in 1981 from the Burroughs to an IBM system running VM/CMS. The introduction of the larger IBM processors meant an increase in the amount of computing power available, and thus a larger, more geographically separated community. The number of terminals attached to the system increased dramatically, as did the number of places in which they were available. Because software was available for a wider range of applications than before, users from departments that had rarely accessed the Burroughs began to regularly use the IBM. Individual departments began equipping terminal rooms of their own; some of these were restricted to students of the department in question, which, of course, physically isolated users even more.

These factors, combined with the much weaker security of VM/CMS led to a number of behaviour problems in the first few years the IBM was in place. The first year the IBM was in general use, some of the undergraduates discovered the password for the user code that handles the remote printers, and signed onto it, bringing all of the printers around the campus to an abrupt halt. The isolation of users, combined with the ability of people with fairly minimal technical skills to cause a great deal of trouble on the system, meant that the old system of informal social controls had broken down.

The extent of the problem this posed was discovered when Queen's attached itself to NETNORTH and BITNET in the fall of 1984. The behaviour of users, particularly some undergraduates, caused a good deal of concern to the system administrators. Not only was highly objectionable pornographic material coming in (and going out) through the network links, but information about various ways to damage the system was being made available as well. It eventually became necessary to prevent users associated with class accounts from sending or receiving messages via the network.The reaction that this produced made it quite clear that communications had broken down between the system administration and at least some parts of the user community. Even worse, there were evidently a good number of users who simply did not consider that they had an interest keeping the system working. The changes in the user community had definitely made new methods of communication necessary.

Of course, when the IBM system arrived, a number of new communication tools arrived with it. From the beginning, mailbox management tools were generally available to users, and communication by means of both notes and messages was possible. Facilities for users assign nicknames to people whom they frequently communicated with were also available.

Shortly after the system was installed, a facility called "Graffiti" was installed. It was essentially a collection of CMS files and a primitive server program, which allowed users to submit requests, and computing centre programmers and administrators to answer them. Graffiti questions and responses were displayed publicly; a system for more private requests for help called "Consult" was established as well.

The note system was refined and expanded; the use of the IBM product Professional Office System (PROFS), and the introduction of the CMS system of notes and notebooks, added a number of valuable features. Particularly useful were the note and message logging features, which made users able to keep records of the notes, messages, and files they had sent and received. However, all of these tools, useful as they were, essentially restricted users to two way communication, whether it was with the computing centre or other users.

The problems experienced with the introduction of the networks had shown clearly that too few users understood the position of the system administrators. When undergraduate users lost the right to access the network, the reaction of some was quite paranoid; and there were enough wild rumours flying around to cause serious concern that the atmosphere in the computing community might be poisoned for some time. To meet the need for new communications facilities, the computing centre upgraded the "Graffiti" system to allow users to add comments to other user's submissions. This not only allowed users to answer questions for each other, it also made it possible for users to comment on answers supplied by Computing Centre staff members. The logical sequel to this facility is the computer conference system "Soapbox", which was introduced about four months later.

Communications and Community: Some Experiences at Queen's

If it is merely stating the obvious to say that the quality of the community that gathers around a computer is determined by the communication within it, it is far from obvious what kind of communication is most important for fostering a community. In search of the answers to this question, I wrote a questionaire (see appendix one), asking a number of questions about the attitudes of the users on "Soapbox". I also interviewed a number of people, including a system administrator, a regular user of the system who does not use the conference facilities, and users who do take part in the conferences. I also analysed a number of "Soapbox" and "Graffiti" discussions, and started discussions on the survey of "Soapbox" users, and how "Soapbox" and "Graffiti" users felt about these facilities.

The "Soapbox survey", as it came to be called, was primarily a survey of user attitudes toward each other and the system administration. It was made a part of "Soapbox", and automated, so that users would be able to fill it out with as little effort as possible. Of the "Soapbox" users who were active at the time, 125 submitted usable answers (two people submitted a response twice, and all their answers had to be discarded).

The respondants were distributed among various user groups in the university, as shown in the tables below.. By far the most heavily represented faculty was arts and science. Few first yearundergraduates answered the survey, but since it was taken in the first months of the school term, it is hardly surprising that few incoming students were aware of the availability of the "Soapbox" or "Graffiti" facilities.

Table 1: Survey respondents by faculty

Faculty	Number	Percent
Arts and Science	59	47.2
Applied Science	26	20.8
Business	9	7.2
Medicine	2	1.6
Other	29	23.2

Table 2: Survey respondents by year

Year/position	Number	Percent
1st year undergraduate	5	4.0
2nd year undergraduate	21	16.8
3rd year undergraduate	20	16.0
4th year undergraduate	19	15.2
MA, MSC, MBA, Medica	22	17.6
PHD (students)	9	7.2
Staff	20	16.0
Faculty	7	5.6
Invalid answers	2	

Unfortunately, it is hard to draw too many really compelling conclusions from a survey with 125 responses. I had hoped to reach some conclusions about the effect of communications on user attitudes, but if there is such an effect, my survey results do not show it. It was impossible to draw very many interesting conclusions, partly because of the small size of the sample, and partly because most users who answered the survey had similar attitudes. While it would be nice to think of that as evidence of a consensus on the system, the survey respondents were self selected, so it is impossible to generalize results to the users who did not answer.

One problem was that the sample basically consisted entirely of "Soapbox" users. Perhaps the most important distinction, in terms of attitudes, is between users who are comfortable enough with the system to use it for relaxation and social contacts, and those who are not. A genuinely random survey of computer users would, I suggest, be a useful undertaking.

If the results of the survey contained no clear evidence that communications facilities were playing a useful part in community building, the responses by users in a "Soapbox" discussion on the subject strongly suggested they were. The responses to a discussion I started about "Soapbox" and "Graffiti", in which I posed a number of questions about the facility, were all positive, and emphasized the enjoyment of discussing issues with other users.[1] I have come to the conclusion that the questions I was asking in the survey about user's attitudes toward other users and the control that the computing centre exercises over the user community were the wrong questions. The attitudes I was measuring were not a measure of user's sense of community. Most importantly, an analysis of the submissions to "Soapbox" and "Graffiti" has convinced me that the user community does exert informal social controls, but it does not exert them directly, through the discussions.

The basic function of a computing community is, of course, to support its members in their work and communication through the computer. The basic means by which this is done is still the exchange of information. The interest the community has in policing itself is to ensure that members do not either deliberately or accidentally make it difficult for one another to work. This basic goal is normally accomplished in two ways: educating responsible users on how they may accomplish their work with a minimum of disruption to other users, and denying information to users who are using it to disrupt the system. Thus, self policing is still based on the basic principles controlling the flow of information: that those users who distribute information about the system have a responsibility to ensure that it will not be used in a way that would harm the work of the user community, and those who receive information are given it on the trust that they will use it responsibly.

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[1] Queen's University Soapbox, discussion #432, "SOAPBOX and GRAFFITI"

Thus, "Graffiti", rather than "Soapbox" is the focus for the computing community's self policing, both because "Graffiti" is still the main channel for information about the system, and because the most effective sanction the community has against an abusive member is the denial of information. By refusing to answer the questions of a user who is behaving badly, members of the community are not simply applying a highly effective sanction; they are also, in practice, limiting the damage that person can do. The idea that information is the currency of any computer system was much clearer in the past, when a single body of knowledge that certain individuals possessed was necessary to use the system; but even now, without the "central bank" of system information, it is the information that determines not only the practical ability to use the computer, but also the individual's status within the computing community.

None of this is intended to suggest that forums for discussion, such as "Soapbox", are therefore irrelevant to the task of ensuring that members of the computing community treat each other properly according to the community's values. As a somewhat crude analogy: "Graffiti" functions, when it is necessary to do so, as a court of public opinion, while "Soapbox" is a forum for the discussion of the shared values of the community, among other things.

For example, on the VM/CMS system it id possible to maintain a user account in a state where it is neither connected to a terminal nor engaged in a specific task for some time. When large numbers of users do this, it creates a load on the system. Recently, an user wrote in "Graffiti" to point out that there were increasing numbers of "disconnected" accounts, and provoked a discussion with one of the system administrators[2], explaining the effect on the system of user's leaving their accounts active at a minimal level as "answering machines" for messages. It was a good example of the use of information to bolster a request to users generally to behave responsibly. In fact, the person who started the "Graffiti" report mentioned part way through it that the number of "answering machines had been reduced. The response from the system administration was also very intelligent and effective; essentially an instruction to users to behave sensibly, and with moderation.

On the other hand, last year, I used "Soapbox" to discuss the rights of users, and the shared responsibility of all users to help prevent abuse of the system[3]. I presented a possible alternative to the "Code of Ethics" that is currently in force at Queen's, which was written to emphasize that user's ethics are not a matter of responsibility to the system administrators, but also of obligations to other users. This provoked a lively discussion, which covered topics from the obligation of users be behave with reasonable courtesy to one another to the various ways in which the rules can be formally enforced by the computing centre, to CMS system security.

Of course, the division of functions here is somewhat artificial. If "Soapbox" and "Graffiti" were part of the same system, instead of being separate programs, the same functions would be carried out in the context of different discussions. The observations here are specific to Queen's, and are a product of Queen's history and the general university environment, as well as the nature of the computing community. However, the larger principles appear to be that the denial of information is an effective sanction; public reproof, while an effective method for other types of communities to deal with irresponsible members, has not been very effective, at least in the Queen's environment. For one thing, an angry note on the computer does not have the impact that confronting the abusive person directly would have. Another reason is that attacks on any member of a public forum provoke a defensive reaction, from the person involved and other users, rather than any resolve to change[4]. An example of this occurred last year, when I wrote into a "Graffiti" report which had been answered by a student who lightly confessed to burning up over three thousand dollars in computer. My angry attempt to call this person's attention to the problems his attitude created for other users and the university was answered by another user, who told me to "develop a sense of humour, and don't take it all so seriously".

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[2] Queen's University Graffiti system, problem 2533779-1

[3] Queen's University Soapbox discussion number 17

Toward New Conference Facilities

Among the wishes expressed by users of "Soapbox" has been the desire to involve more people in the conferences. While there is no way of knowing how many users read discussions without participating in them, it is clear that only a small minority of the thousands of users on the computer regularly contribute to "Soapbox".

Unfortunately, there are an enormous variety of reasons users choose not to get involved in "Soapbox". As part of the research for this paper, I interviewed a user who often works on the computer, but does not use "Soapbox" or "Graffiti". Her reasons did not surprise me; she had higher priorities than using the computer, and preferred to socialize with her friends in person. One thing she mentioned was that the computing facilities at Queen's are physically uncomfortable to use, a problem that has been mentioned more than once to me. Comfortable typing chairs are not on most people's lists of communications facilities; but it is at least partly the lack of comfortable chairs that is preventing one user from being as fully involved in the user community as she otherwise might.

Other reasons for users deciding not to participate in conferencing may be easier to deal with than uncomfortable surroundings. On "Soapbox", part of the problem may be the intense nature of the debates, which often seem like verbal combat. To some extent, the intensity of debate reflects the emotional involvement of the participants in the subject, but there is another factor: the participants in "Soapbox" are not required to sign their names. Some "Soapbox" users sign their names; others simply sign their identification numbers; but many users make up pseudonyms that do not reveal their correct names.

The question of anonymity came up a twice in interviews with widely differing users, who agreed that allowing anonymous comments subtracted from the quality of "Soapbox" discussions. Certainly, the nature of many discussions is affected by the number of participants who are anonymous or using pseudonyms. As one of the system administrators pointed out, "anonymity breeds irresponsibility". To the valid objection that it is very frightening for some users to reveal themselves to the larger community, I suggest allowing "restricted" conferences, a feature that "Soapbox" does not possess.

Summary

At the start of this project, I was expecting some fairly straightforward answers about the place of a computer conference in a computing community. I now believe that no such straightforward answer is available. The characteristics of the community that gathers around the computer are far more important in shaping the nature of the community than the characteristics of the communications tools in use. What this means for conference systems design, I believe, is that flexibility is the most important attribute of a good conference system. It must be possible to tailor it for the individual users as well as the community as a whole, for in the end, it id the community, and the needs of the community, that brings the computer and its communications facilities into existence, not the computer that creates the community.

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[4] Queen's University Graffiti system, problem 2252428-5
Also, see Queen's University Soapbox discussion number 115 in which an anonymous user attacked me for being pompous. I hope this essay doesn't leave readers agreeing with him.

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Appendix: Soapbox Survey Questions

1. What faculty are you in?

    1 Arts and Science
    2 Applied Science
    3 Business
    4 Medicine
    5 Nursing
    6 Other

2. What is your position at Queen's?

    1 1st year undergrad
    2 2st year undergrad
    3 3st year undergrad
    4 4st year undergrad
    5 MA, MSC, MBA, Medicine, Law
    6 PHD
    7 Staff
    8 Faculty

3. Computing services exercises a certain amount of control over the users of soapbox. Do you think they have

    1 not enough control
    2 the right amount of control
    3 too much control

4. Do you think the computing centre pays enough attention to the wishes of the users?

    1 No, never
    2 No, very seldom
    3 No, not much of the time
    4 Yes, some of the time
    5 Yes, most of the time
    6 Yes, all the time

5. If another user was interfering with your use of the system, would you

    1 report them to computing services
    2 tell your friends to talk to them to help you get them to stop
    3 send them a note or a message asking them to stop
    4 do nothing about it
    5 not have any idea what to do

6. What do you think the most effective regulator of behaviour on the system is?

    1 The individual user's ethics
    2 The opinons of other users
    3 The threat of being thrown off the system by computing services

7. Do you think the opinions of other users are

    1 irrelevant
    2 somewhat important

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3 very important
4 most important

8. Users should be permitted to do

1 nothing that is not related to their course work
2 anything that is not liable to inconvenience or offend other users
3 anything that does not actually inconvenience or offend other users
4 anything that does not actually inconvenience other users
5 anything that does not prevent the system from running properly.

9. Computing Services sometimes removes the userids of people who break the rules. In what cases do you think this is appropriate?

1 Never
2 Only in cases where abuse damages the system
3 Only in cases where abuse seriously inconveniences other users
4 In cases where abuse inconveniences or offends other users
5 In any case where the rules are broken

10. Soapbox should be most used for

1 Nothing-- it's silly and a waste of resources
2 Serious discussions on important topics
3 Self expression of all kinds

11. Do you often strongly agree with the people who write on SOAPBOX?
1 No, never
2 No, almost never
3 No, not often
4 No, not as often as I disagree
5 Yes, fairly often
6 Yes, most of the time
7 Yes, almost always
8 Yes, all the time

12. Do you often strongly disagree with the people who write in SOAPBOX?

1 No, never
2 No, almost never
3 No, not often
4 No, not as often as I disagree
5 Yes, fairly often
6 Yes, most of the time
7 Yes, almost always
8 Yes, all the time

13. Are you interested in the topics discussed in SOAPBOX?
1 No, not interested in any
2 No, only interested in one or two
3 No, not interested in most topics
4 Yes, a few of them
5 Yes, some of them
6 Yes, all of them

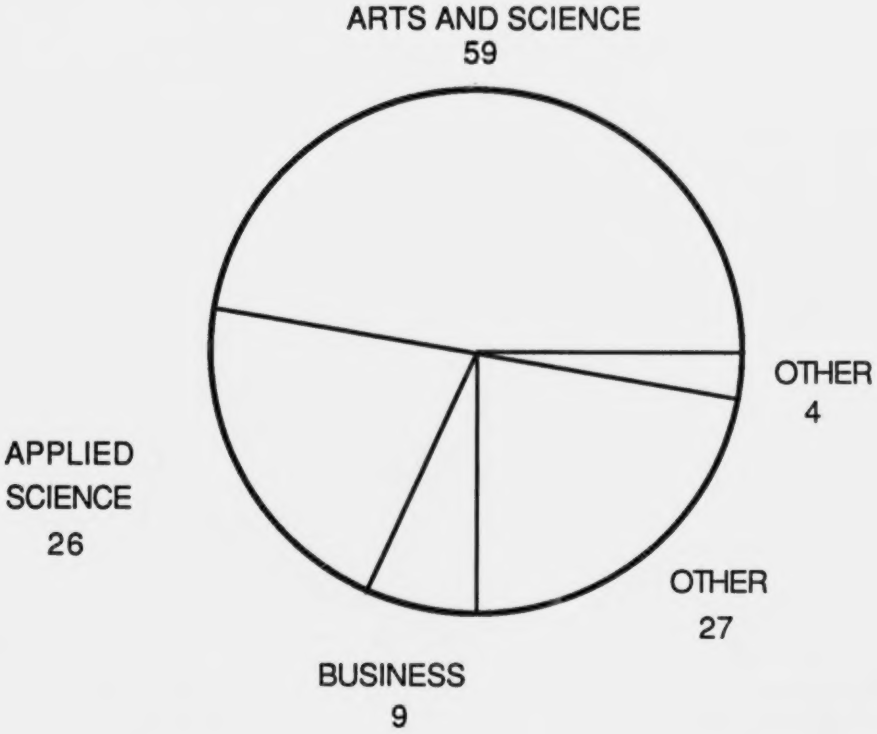
14. How many of the people logged on the computer now do you know?

1 No one but myself
2 One other person
3 two other people
4 more them two but less then five people 5 more than five people

15. Do you send and receive notes and messages to and from friends on the computer?
1 Never
2 Seldom
3 Frequently
4 Almost every time I log on

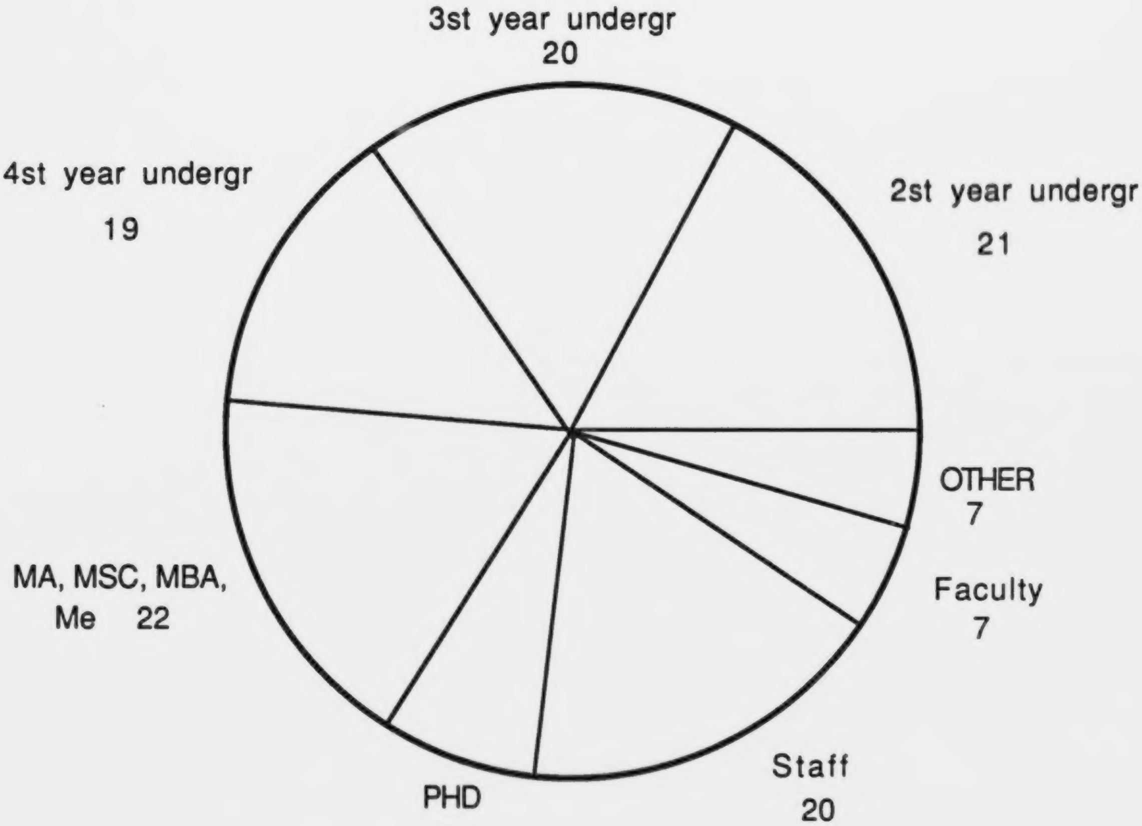
SOAPBOX SURVEY

FREQUENCY OF SSV001



SOAPBOX SURVEY

FREQUENCY OF SSV002



Computer Conferences: What Makes Them Difficult, and For What Types of Conferencing Situations Are They Most Suited?

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ABSTRACT

Following a chatty discussion of the computer conferencing experiment performed with the students in a computers and society class, thirty findings are advanced relative to the interpersonal nature of computer conferences in which simultaneous participation is disallowed. The purpose of this discussion is to introduce the theoretical foundation of the experiment and present a sufficiently clear understanding of what was done so that the results are properly qualified. Appearing in an appendix are all experimental instructions to participants.

The findings, all pertaining to facets of the conferencing milieu offering resistance to task oriented progress and how to overcome it, are grouped into five categories: statement-response chaining, the moderator, structurally endemic norms, interaction viewed through the concepts of Bales, and group cohesion.

INTRODUCTION

Hiltz and Turoff's trailblazing treatise, The Network Nation (1978), was extraordinarily prescient. Virtually every distinguishing psychological and sociological aspect of computerized conferencing was identified. Of those made the object of concentrated study, their conclusions, with time, have proven correct.

Here I report on the exploration by a computers and society class, composed of advanced computer science undergraduates, on the group dynamics of computer conferences. Our aim was to extend understanding of the human factors associated with computer conferences that might account for the failure of this promising communication modality to be as widely adopted as anticipated. Certainly, there are no technical reasons Hiltz and Turoff's prediction that "computerized conferencing will be a prominent form of communications in most organizations by the mid-1980s" (1978, xxix) should not have materialized.

SENSITIZATION TO THE STUDY OF GROUP DYNAMICS

As in the hard sciences, the only way to gain solid knowledge about interpersonal processes is through empirical investigation. Not only do thoroughly counterintuitive findings turn up from time to time, but a priori lines of speculative analysis by different thinkers can lead to contradictory conclusions.

Speculative Inference Applied to Telephonic Conferencing

To illustrate how speculation can lead to contradictory expectations and to introduce the ideas and thinking we applied in studying computerized conferences, I shall exemplify with some armchair hypothesizing about small, task-oriented group meetings held over the phone via a conference line. The dominating questions center on the importance of kinesics (e.g. nods of agreement, facial gestures expressing confusion, eye contact, bodily positioning, and the like) to the smooth the functioning of problem-solving groups. Suppose, in particular, we focus upon the nature of idea pooling, idea sifting, and consensus formation.

While the telephone removes all visual cues normally significant for interpersonal coordination, it does not eliminate nonverbal communication altogether. The possibility of nonlexical cuing (e.g. keep-going signals like "gee," "gosh," and "hmm;" voical intonations; groans; sounds of laughter; and the like) remains. It may be that there is an increase in nonlexical communications to compensate for the loss of kinesics, and that these nonlexicals are sufficient for satisfactory social regulation. On the other hand, it may be that things that could ordinarily be conveyed subtly (e.g. group rejection of an idea registered by not according the one who proffered it encouraging nods and sustained eye contact) would have to be made explicit. Explicit rebuffs could cause offense and result in interpersonal friction. As a consequence, group efficacy could be impaired as alienated members withdraw either in fact or in spirit through a loss of felt allegiance. Fearful of damaging cohesion through the detrimental effects of explicit negativism, it could be that the group refrains from such with the ultimate consequence that no bad ideas are rejected and no good ideas adopted. In other words, the group could be too fainthearted to make the decisions necessary for linear progress toward its objective goal.

Alternatively, there could be an entirely different systemic reaction to the loss of visual cues. Since the pioneering work of Robert F. Bales at Harvard throughout the late 1940s and the 1950s, it has been known that small, informal, task-oriented groups have two sets of problems and two informal (i.e. spontaneously emergent) leaders: one leader, the maintenance leader, does conspicuously more than any other participant to help the group contend with socioemotional difficulties (e.g. hurt feelings or a lack of adherence to group norms); the other leader, the task leader, contributes the predominating ideas and the strongest guidance relative to accomplishing the ostensive objective. To be a task leader requires a transcending degree of pertinent knowledgeability. To be a maintenance leader, though, is not simply a matter of personality. Bales unequivocally found it to require a high degree of capability in the realm of the task. Whereas the task leader is generally the most informed relative to the task, the maintenance leader is the second most informed. To be a creditable ambassador of the ideas from the task leader, the maintenance leader must be recognized as adept.

In a telephone mediated conference it could be argued that special interpersonal skills are necessary for effectiveness as a maintenance leader; in particular, an ability to manifest a lightness of touch exclusively through verbal means. Lightness of touch would include being able to cast criticisms of ideas or behavior in such a way that it is clear that its recipient as a person is not being denigrated or defamed. One way of achieving a lightness is through a jocular mien created with a tone of voice, a feigned accent, or the use of colloquialisms. (Erving Goffman (1961) subsumes this with his concept of role distance.) Suppose that this role distancing ability is the overriding factor in the early emergence of the maintenance leader. It may be that the maintenance leader, emerging on the basis of personality, is not up to the function from the standpoint of task knowledgeability. The group could, therefore, lack such a leader when it needs one most -- when factional disagreement crescendos to a point of unresolvability and acrimoniousness.

The Lesson Relative to Studying Computerized Conferences

Speculation could continue about the nature of party-line conferences in contrast to face-to-face conferences, and at least as much could be formulated relative to the nature of computer conferences which are even more alien. Two salient derivatives from the above discussion bearing upon the development of insight into the interpersonal nature of computer conferencing are that:

- o the situation is sufficiently unfamiliar that it defies the formulation of specific hypotheses in which it is possible to have a high degree of confidence
- o there exists a body of concepts, typologies, and empirical realizations of proven utility in studying interpersonal interaction in groups

The first point suggests that less formal, less constricting research than of the hypothesis statement-and-test variety seems appropriate. In specific, properly pitched investigation would be research of the hypothesis-generating kind, something akin to an ethnographic examination of what goes on. An ethnographic examination amounts to observation conducted with sensitivity to aspects of action that are of suspected centrality for the purpose of extricating fundamental, empirically rooted understandings.

The second point suggests that a clear-eyed, feet-firmly- planted-on-the-ground investigation of computer conferencing is not enough. A degree of social scientific sophistication is necessary. Note that Hiltz and Turoff (1978) drew extensively upon the social scientific literature. Bales's typology for Interaction Process Analysis figured so prominently in their work that they printed it on page 106. Goffman's foundational concern with "the presentation of self" was important enough for a lengthy explanation, with a substantial direct quotation, on the meaning and significance of a "personal front" (pages 87-88 and 94). Incidently, Goffman (1981), in a book appearing several years after The Network Nation, had much to say of extreme relevance to the problems occurring when computer conferees make simultaneous inputs and when statements and replies become separated in time.

THE EXPERIMENT

Overview

The conferencing experiment was the centerpiece around which the computers and society class was organized. The students began by reading The Network Nation, the CACM piece by Hiltz and Turoff (1985) on "Computer-Mediated Communication Systems," and selected portions of the social scientific literature, including Goffman's essay on "Role Distance" (Goffman, 1961) and "Forms of Talk" (1981). Once this was assimilated, each student formulated a set of suppositions to pinpoint aspects of interaction in computer conferences deserving of deliberate watchfulness. Our particular interest, of course, lay in factors making conferencing difficult and strategies for overcoming them. Students' suppositions served as hunches about where to look to find something; they increased the likelihood that nothing of importance would be inadvertently neglected. Then the students served as the participants in the conferences. Finally, when all the data was in, the students studied the transcripts of the conferences to see what might be gleaned.

Data came from nine conferences. Each student participated in one of each type. Three conferences focused on solving a puzzle adopted from one originated by Sam Loyd (Gardner, 1959, page 12); three others focused on forging a group opinion on a subjective question previously used in a study of the risky shift phenomenon (Rim, 1964); and three conferences focused on devising a plan of action with ambiguous and controversial elements. The job given to this last set of conferences was designed to promote the full range of task and socioemotional difficulties needed to bring to life all facets of group dynamics studied by Bales. Vignettes defining each of these three tasks, along with general instructions to the participating conferees, are contained in the appendix.

Qualifications Bearing on Generalizability of the Results

Because we lacked facilities for supporting computerized conferences on our mainframe (an IBM 4381 operating under MUSIC) and because we lacked a local area network for linking microcomputers around the University, we decided to simulate computer conferences with composition books left at a central location.

This meant there were critical, distinctive aspects of the authentic computer conferencing milieu completely beyond our investigative purview. Among these are:

- all complications arising when two or more conferees are logged-in and interacting simultaneously in "a synchronous discussion" or "on line 'party'" (as discussed by Hiltz and Turoff, 1978, pages 90-93)
- all special rituals that develop in connection with "leave taking" (logging-off from sessions in which more than one conferee is online; discussed by Hiltz and Turoff, 1978, pages 111-113)
- all consequences following from the likelihood of conferees' becoming "addicted and dependent" (i.e. excessively attentive to conferences; discussed by Hiltz and Turoff, 1978, pages 102-104)
- possibilities arising when participation is as readily undertaken as turning on the PC at one's desk (in contrast to the discouraging inconveniences of bodily transporting oneself to a composition book on reserve in the library)
- possibilities for sociability existing in conjunction with online, real-time conversations

Although it is essential to consider these exclusions as limitations on the generalizability of our findings, they do not relegate them to unreality. Firstly, there is no single manner in which a bona fide computer conference must be organized or must always proceed. It may just be that certain real-life conferences, for various reasons, rarely or never involve two or more conferees online at once. Surely, the interpersonal facts about situations such as these are important to establish in an empirical way. Secondly, it may be of important theoretical value in understanding the group dynamics of computerized conferences to have analytic insight into the predisposing influences of individual properties in controlled isolation.

A further feature of our conferences differentiating it from many is that our conferees, if they did not know each other individually, at least knew the most salient general "social data" about the others -- age, occupation (i.e. student), competencies, and how they happened to be involved. This meant that the need to establish the social locations of the different conferees was not felt (Hiltz and Turoff, 1978, page 83) and the apparent opening "push toward sociability," where people were "friendly and personal" in the exchange of information about themselves (Hiltz and Turoff, 1978, pages 111-113), would have been in substance superfluous.

Finally, it must be understood that our conferences were small, highly goal directed groups without a designated leader (or moderator). Concretely, each conference contained between five and nine participants, meaning that the groups were sized so that each conferee could keep track of the identity, contributions, and rate of participation of each of the others. As goal directed groups charged with solving a specified problem, the conferences were neither educational nor recreational forums in which membership was individually voluntary and collectively shifting; our conference groups persisted in time with a stable dramatis personae. Moreover,. that signs of personal accomplishment were bound to aggregate success, as per evaluation by an external agency, contributed further to the promotion of a sense of group identity. Without an exogenously appointed leader, the conferences were most reflective of situational task and maintenance and exigencies and were very much like ad hoc committees in which social structuring could be established in accordance with explicit group planning (e.g. deciding to select one of their own to act as moderator). By design, the conferences were parallel in nature to the groups used by Robert F. Bales to elicit the full gamut of social systemic forms associated with groups of executives or professionals regularly meeting to solve a particular problem.

FINDINGS

Each finding was either an a priori supposition borne out by observations during the on-going proceedings or later analyses of the transcripts of our nine simulated computer conferences or a conclusion reached directly from the latter. Findings are numbered for reference.

Statement-Response Chaining

The theoretical reference for this collection is Goffman (1981). The importance of this area is the potential for chaos caused when multiple online conferees respond simultaneously to single stimuli and the disruption of continuity and idea development caused by interruptions in real-time conversational interplay because conferees are not online at the same time.

1. The greatest impediment to interaction arising from the nature of the computer conferencing situation is the difficulty of addressing communications to specific participants and obtaining their replies. Because a conferee never knew when a particular other would again login, the development of question-answer and statement-response adjacency pairs and chains of sustained conversation did not materialize. What is more, it was implicitly obvious to the participants that immediate returns from particular others could not be expected. The implication was that communications were, except in special cases, impersonal observations addressed to the group as a whole or to the moderator. Conversely, participants did not feel the need to answer communications from some time ago relating to their own inputs because the relevance of a current reply was deemed low. Typically, the last conferee to login would respond to the existing state of affairs, whatever it might be -- the remark of the last conferee, the focus of an exchange in progress, or a perceived transcending exigency (such as the need to make a decision as time was running out).

2. Confusion over referents was never a problem. If a participation related to something other than the immediate focus, the referent was spelled-out (e.g. with a reference to a past communication number or with a verbal description defining the new view, concern, or topic).

3. Despite the ready availability of transcripts of an entire conference's proceedings, retrospection is rare. Beyond reading the material to have accumulated since last login (which is not always done in its entirety), conferees seldom review the past.

4. The second greatest impediment to interaction in its familiar form was long-windedness. Wordiness of communications seems a structural consequence of the preclusion of ellipsis and other truncated verbal forms owing both to temporally noncontiguous adjacency pairs and the absence nonverbal channels.

The Moderator

5. The primary job of the moderator in facilitating task success is to organize information and, to an extent, regulate participation. Both functions have to do with overcoming the fact that answers to questions or remarks about specific assertions may be separated by substantial chronological and/or participatory distance.

6. The more experienced the moderator in computer conferening, the better the conference performs.

7. The more knowledgeable the moderator in group dynamics, the better the conference performs. Specifically, the moderator who appreciates the phase movement of groups toward the solution of its problem (i.e. from "orientation" through "evaluation" to "control") and who directs the conference to tackle matters in their pyramiding logical order is more likely to catalyze success. Taking matters out of developmental order results in confusion, disagreement, and backtracking.

8. The more the conferees know about the nature of computer conferencing and the repertoire of mechanisms useful for enhancing progress, the less resistance they have to accepting the moderator's intervention and the more likely they are to adopt streamlining conventions.

Moderator interventions may include:

- attaching "about lines" to inputs
- editing inputs (e.g. to make them more concise; to divide single inputs into two or more separate entries with different "about lines")
- re-sequencing arriving communications to place them into a more logical order than that of their chronological appearance
- periodically re-grouping communications in a fashion more destructive of arriving chronology to put relating inputs closer to each other and to clarify logical flow
- restricting certain communications from entry into the conference's public domain (i.e. censorship)
- establishing "an appendix" into which to put lengthy elaborations and "flaming"
- promulgating norms to remove inhibitions over spelling, grammar, and polished phraseology

Streamlining conventions may include:

- the use of annotations within inputs (* like this *) to convey "communication about the communication" generally of the type expressed nonverbally (e.g. tone of voice or facial pose)

- the use of graphics within communications such as :) or :((* smile and frown *); spacing for emphasis; and UPPER CASE for shouting
- using "telegraphese"
- for longer communications, formatting the text so that its visual appearance facilitates scanning
- restraint relative to length

9. The better able the moderator to elicit judgments from all members of the conferencing group relative to both the problem at hand and the contributions of the others, the more effective the group. Judgments about the problem tend to be contributions in prose; and these delineate fundamental definitions,interpretations, and the range of possible solutions from which the one adopted will come. Judgments of the contributions of others may be refinements in prose or melded opinion externalized through a consensus-taking poll.

10. The best progress is made with the extensive use of polling and the prohibition of backtracking to matters which have been settled. The moderator allows an issue or issue cluster to be considered until conferees have had their say and not much substance of additional practical value seems forthcoming. The conference is then polled. If aggregate feeling is equivocal, the pursuit of the issue is resumed with an appropriate amount of guidance on what to dwell. However, once the moderator deems an issue decided, backtracking to re-resolve it is strongly discouraged.

11. Low participators are the conferees most likely to be responsible for pushes toward backtracking and/or exhibits of frustration and negativism as task advancement takes place in the absence of their influence. A sufficient amount of polling helps to allay these strains.

12. When no moderator is externally appointed, conferences that act quickly to choose a moderator are much more likely to be task successful than conferences which delay or fail to choose a moderator altogether.

13. Without a moderator, interaction remains desultory and there is little linear progress toward goal accomplishment.

14. An ineffective moderator tends not to be unseated, but conferees make explicit requests for moderator service.

15. The more anxious the conferees feel (e.g. because of an impending deadline for which the group is unprepared), the better they tolerate the organizing efforts of the moderator.

Structurally Endemic Norms

Structurally endemic norms are behavioral constraints (prescriptions and proscriptions) which seemingly arise spontaneously as concessions to the conferencing situation. They are the adjustments realized through common sense as expedient.

16. Norms arose, without explicit prodding, which had the effect of countering inhibitions against communicating in writing. One constellation of norms countered fearfulness of those language mistakes that might cast one's literacy and intelligence in a bad light. Misspellings, ungrammatical forms, false starts, linguistic inelegancies and the like were accepted without comment and, after a short while, became increasingly prevalent (presumably as conferees communicated with decreasing premeditation and strain). The other constellation of norms countered a timidness to cast things in writing that might usually be spoken unhesitatingly -- things not literally true, exaggerations, colloquialisms, and irreverences. The norms were to accord conference entries the same ephemeral status of speech: apart from what applied specifically to the task, the particulars of entries were not dissected.

17. The need to write intelligibly was recognized and universally heeded right from the beginning.

18. Conferees with an established group identity, established either during the conference through participation or established from acquaintanceships prior to the conference, are less concerned with the covert qualities of their participation tending to reflect upon their character and personality.

19. Apparently, there was little need felt to explain, apologize for, or joke away inadequacies of substance in one's contributions. This implies that a lack of that verbal and social acuity required for the adept protection of one's person from embarrassments (i.e. "role distancing ability") is not requisite for active participation. This was surprising to us. Perhaps it is attributable to a generalization of the relative egolessness associated with the grammatical mechanics and literal content of inputs. Perhaps it has to do with the fixedness of the conferencing group on successful task accomplishment working to discourage inputs of a self-serving nature. Probably it resulted as a synergetic combination.

Interaction Viewed through the Concepts of Robert F. Bales

Robert F. Bales revolutionized group dynamics with his typology for Interaction Process Analysis and the understandings he contributed of small, informal, problem-solving groups as social systems. Among his concepts are those of task and maintenance leader; the process accounting for their emergence; and the "orientation, "evaluation," and "control" phase movement of groups.

20. The informal leadership positions of task leader and maintenance leader identified by Bales were absent in our conferences. The only position of structural-functional salience was that of the moderator. The moderator, once chosen, acted precisely like an externally appointed leader in his or her preemptive attention to both instrumental and socioemotional needs.

21. When the task involves a relatively straightforward, technical problem; a member with the required expertise (or access to this expertise) tends to prevail with the other conferees agreeably acquiescing. When the task involves a multifaceted, subjective problem there is a substantially greater amount of idea contribution and interaction.

22. A veritably single-minded concern with solving the objective problem at hand coupled to both the lack of opportunity for free-floating schmoozing (such as before and after conventional face-to-face meetings) and the difficulty of personal socialization in this type of conferencing situation reduced the amount of noninstrumental communication to virtually nothing. There is little of direct

personal gratification gained from participating in this type of a conference.

23. Humor was present in all conferences. Its usual forms were zany task-pertinent suggestions and trading good-natured insults.

24. A classic finding in small group research is that the more concerned the group members with being well liked, the blander and less useful their inputs. Fear of giving offense inhibits the candid expression of contrary opinions. In our conferences, acceptance by the group had little personal value so conferees were not disinclined to contradict. At the same time, the physical isolation of the of the conferees contributed to a sense of anonymity which made heatedness over differences all but unknown.

25. Stress due to an impending deadline causes an increase in the rate of input. Virtually all this increase is in the category of idea contribution (type B communication) and little is in the category of idea sifting (communication types C and D). At such times the moderator's problems of organization, coordination, and opinion polling are intensified; but the conferees better tolerate executive direction. Conferees may even welcome the moderator's decreeing final pronouncements.

Group Cohesion

Group cohesion, the sense of "we-ness" felt by the members of a group, is both the most sensitive single indicator of the aggregate's wellness and the best single predictor of aspects of the members' group behavior viewed individually (e.g. dedication to group causes and friendliness toward other members) and aspects of the group's behavior viewed as a collective.

26. Level of cohesion is a function of the value of group membership; in other words, how much the individuals themselves get out of belonging. The most reliable way to bolster the cohesion of a computer conference is to give the group a high public profile and endow membership with high prestige.

27. The more cohesive the conference, the more terse can be the constructive filtering of communications (e.g. the rejection of inferior contributions) without begetting bad feelings and hostility. The overall effect of the conference's fortification to sustain such abruptness without socioemotional repercussion is enhanced task efficacy. However, outright personal attacks, especially if delivered without a mitigating lightness, will engender negativism and a threat to cohesion, though not so strongly nor so surely as in conventional face-to-face groups.

28. With seven or fewer participants in a computer conference (though seven is not an absolute cutting point), it is reasonably easy for each participant to keep track of each of the others without conscious effort. "Keeping track of" entails an impression of recency of last login, frequency of participation, customary participatory style, and stance on issues. Cohesion is heightened considerably, and sense of responsibility to the group cemented, when the group is able to accord each conferee a distinctive, persisting identity.

29. Humor in a conference enhances cohesion in two ways: it increases the perceived attractiveness of the other conferees and it evokes more frequent participation as it makes participation more fun.

30. More frequent opinion polling enhances cohesion to the extent that it

facilitates visible progress and maintains input from otherwise low participators.

CONCLUSIONS

The paramount difficulties in computer conferencing arise in connection with the impediments to the development of statement- response adjacency pairs. Hiltz and Turoff (1978, pages 90-93) document the problems that result when multiple conferees are online at once: the temptation for conferees logging in when live exchange is in progress to participate without doing the reading to become familiar with the background, and the sequencing problems that occur when two or more conferees are generating input simultaneously.

Our conferences brought into view the problem resulting when conferees could not plan on responses to their questions and replies to their statements from specific others. This caused an excessive number of remarks to be addressed to the group as a whole (or the moderator) and to be impersonal in tone. A further result seemed to be a greater number of different suggestions and ideas (more type B communication) with less conversational exploration of each and less overt idea filtering by the group at large. The moderator assumed the lion's share of the responsibility for this last, and he or she exercised it through the application of discretion and consensus polling.

The other problem our conferences exposed, also following from the situational detriments to communication chaining, was the need for more verbiage than is found in face-to-face interaction. Because a current communication could not be assumed to be a response to an immediate temporal predecessor, making context clear and an abbreviated return satisfactory; here referents had to be identified and, sometimes, accompanied with couching explanation. This exacerbated the difficulty, intrinsic to all conferences, of externalizing reactions ordinarily communicated nonlexically or altogether nonverbally.

A factor which turned out not be a problem was inhibition to communicate because of the non-ephemerality of written inputs. Where both excessive verbal premeditation and caution relative to substance may have been expected, a lack of contrivance and spontaneity were observed. Just as norms against evaluating the grammatical and linguistic form of communications universally arose, so did norms proscribing the retrospective review of inputs to hold honest mistakes and innocuous misstatements against conferees.

The findings suggest that computer conferencing is highly effective for small, problem-solving groups composed of individuals who have met each other. Keeping the conference small enough so that conferees can develop identities in the eyes of the others enhances group cohesion, and this benefits goal attainment. If the conferees have met face-to-face prior to the conference, effort is spared that would otherwise have been devoted to "social placement" (Hiltz and Turoff, 1978, pages 83- 88). Though there is little about our conferencing situation that is humanly warm and nurturing, a sufficiently strong goal directedness on the part of conferees will promote conscientious participation. Probably conferences in which there is little equivalent to the possibility of a pat on the back from the relatively removed others and in which there is no possibility of individual recognition for outstandingness beyond the confines of the conference should be recommended only for aggregates intensely committed to objective accomplishment.

Of utmost importance is the early appointment of a moderator who knows a respectable amount about the _ad hoc_ problem, a good amount about the options open for conference moderation (acquired through conferencing experience), and something about group dynamics. Without an active, effective moderator discussion tends to be meandering. The moderator assumes the _de facto_ custodianship for group success and is, by far, the hardest working of all the conferees. It may be that conferencing systems should provide professional moderator services, though it is doubtful that conferences of executives or professionals would trust a "secretary" from beyond their number with the discretion the moderator must have.

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APPENDIX

CS 202 Spring Semester, 1986

The Computer Conferencing Experiment

** Instructions to Participants **

Each participant will have to take part in three independent computer conferences:

Conference I: aimed at solving a somewhat confusing accounting problem

Conference II: aimed at reaching a group-endorsed recommendation on a choice faced by a hypothetical person

Conference III: aimed at formulating a plan of action to achieve an objective; conferees will be asked to assume that the devised plan is one that they themselves will subsequently implement

All conferences begin on Tuesday, February 18. Each, however, has a different end data:

Conference I: ends on Monday, March 3, at noon

Conference II: ends on Monday, March 10, at noon

Conference III: ends on Monday, March 24, at noon

The quality of the product of each conference will be judged:

Conference I: the evaluation will be based on the objective accuracy of the answer

Conference II: the evaluation will be based on a subjective appraisal of the soundness of the group's opinion

Conference III: the evaluation will be based on the apparent efficacy of the plan; hallmarks of a likelihood of success are general strategic feasibility, attention to details, and explicit decisions relative to who will do what (when and how) in carrying it out

Prior to beginning each conference, each conferee will receive a sheet of paper in an envelope describing the respective problem. You will get these on February 13 -- one envelope for each of the three conferences in which you will take part. Before your first participation in a conference, you should have read its descriptive vignette. In each case, your vignette is a correct though not necessarily complete characterization of the situation. It is possible that others possess information or instructions that you lack (and vice versa). DO NOT LET ANYONE ELSE READ YOUR VIGNETTES.

Procedures and Rules

1) You may participate only in the conferences to which you have been assigned. Do not "login" to other conferences for the sake of browsing. We want to avoid the possibility of happenings in one influencing happenings in another.

2) You may participate in your own conferences as often as you like and contribute as much as you want. However, at the very minimum you must "login" (that is, read what has been taking place) twice a week.

3) To participate, borrow the conference's composition book from the Reserve Desk at the Library. You will know the identification names of each of your conferences and whether their books are at PUP or CWP.

4) Under no circumstances tear out a page or a portion of a page from a composition book.

5) In contributing, please write neatly enough to make your input easily readable. Certainly use abbreviations, be informal, and do not worry about spelling or grammar. (What's important is that you are not stifled. You must give the conference the benefit of your thinking and make known feelings that are on your mind. This ain't no COM101 or COM102!)

6) Inputs to the conference do not have to be made in real time. You may write (or type) your contribution(s) away from the composition book and then Scotch tape them in.

7) As the first thing with each participation, "login" by giving:

ENTRY NUMBER NAME DATE TIME

ENTRY NUMBER: Entry numbers make it easy to pinpoint particular contributions for reference. This will be helpful to conferees and helpful later when studying what went on. The very first entry number is #1. The second is #2. Suppose that the first time you "login" to contribute the last entry was #18; your contribution will be #19. No matter how short or how long your current contribution, it is #19. The next person's contribution will be #20.

NAME: You will be assigned a code name (e.g. SA, JG, TM). You may identify your contributions with your code name, your actual initials, your first name, your nickname, or whatever you like.Identifying yourself makes it possible for the others to ask you questions about things you said, and it enables them to build-up an idea of where you stand on matters of conference concern.Anonymous contributions are allowed. For these, instead of you appellation (i.e. conference name), enter ANON. Give the entry number, date, and time as usual.

DATE: If Scotch-taping in a contribution, record the current date and time -- that is, the date and time at which you are doing the actual Scotch-taping.

TIME: Don't forget to record a.m. or p.m.

8) CRUCIAL: ONLY INTERACT ON CONFERENCE MATTERS THROUGH THE COMPOSITION BOOK.

Don't discuss any conference matter, regardless of how insignificant it may seem (e.g. a feeling about a certain conferee, a joke about what is happening, an observation about the medium), except in writing through the composition book. Even a seemingly trivial face-to-face communication could be the basis for the crystallization of an alignment that could confound us when we study the written record trying to figure out the hows and whys of the group's dynamics.

Further, don't discuss any aspect of one conference with anyone in another conference (except as a contribution through the composition book). What we want to prevent is bias in one conference's proceedings from creeping into another's in unobserved ways.

9) "Whispering": You can "whisper" private remarks to a fellow conferee by:

i) writing the communication to be whispered and heading it as described below,

ii) sealing it in an envelope, and

iii) delivering the envelope to the recipient in one of the ways described below

The rationale behind the procedure for "whispering" is to allow private communications but to enable a complete record of these to be kept for subsequent study of the conference's group dynamics.

DELIVERY: Delivery may be made by attaching the envelope to the composition with a paper clip or a rubber band.

> RULE: Only remove envelopes addressed to you (or uncollected envelopes from yourself that you wish to withdraw).
>
> The identity of the sender ("return address") does not have to show on the envelope.

Alternatively, you might deliver the envelope via room drop-off (e.g. in the dorm), the U.S. mail, the courtesy of a friend, or hand-to-hand. This last is the least desirable since there is a risk that the envelope will be accompanied with a meaningful (though unintentional) nonverbal message.

HEADING: The "whisper" should be headed in the following way:

SENDER'S NAME TIME DATE DELIVERY MODE RECIPIENT

The TIME and DATE should be when the whisper was written. DELIVERY MODE should show how the sender got the envelope to the recipient -- affixed to composition book, campus mail, dorm room drop-off, hand delivery, other (specified).

All "whispers" must be prepared in duplicate. One copy is transmitted to the recipient, and one copy is kept by the sender. Both copies must be saved and submitted to the instructor by the close of the conference.

The recipient must sign and "time stamp" (i.e. record the date and the time) on his or her copy upon reading it.

10) Be aware that conferences are free to establish operational guidelines as they see fit.

Conference I: Accounting Problem

** Deadline: Monday, March 3, Noontime **

Tax returns are soon due. A used car dealer, in the midst of computing his, has run into a problem. He can't figure out how much he made on a certain vehicle.

> What happened:
>
> He sold a car for $5,000. Shortly thereafter he bought it back for $4,000. He then sold it again for $4,500.
>
> Computation I: (Worst vis-a-vis the tax implications)
>
> In buying back the car for $4,000, he made $1,000 since he had the same car plus the

thousand dollars besides.

In buying it back for $4,000 and reselling it for $4,500 he clears another $500 more.

In total, then, he made $1,500 upon which he has to cough-up taxes.

Computation II: (Better vis-a-vis the tax situation)

In selling the car for $5,000 and buying it back for $4,000 the dealer made a clear $1,000.

After the buy-back, though, the car was actually worth $4,500. Consequently, in reselling it for $4,500 he made no profit; that transaction amounted to an even exchange.

Hence, he made $1,000 upon which he has to pay taxes.

Computation III: (Optimal)

At the outset the dealer had a car worth $5,000. In selling it for $5,000 there was no profit. ("I was strapped for cash at the time.") This was an even exchange.

In buying back and reselling there was a definite $500 gain. That the car had been sold by the dealer in the past is irrelevant.

Taxes, therefore, have to be paid on $500.

Your Instructions:

The dealer is a computer buff linked to an electronic network on which he has many friends -- people from all walks of life (students, accountants, retailers, etcetera).

You are one of his friends.

This evening he asks those of his friends who are loggedin for help: He wants to minimize his taxes, but he has to stay within the bounds of legitimate accounting procedure (he had an audit last year and is being closely watched for possible violations).

You are within a group who became interested in the problem and in determining what the correct computation should be.

The conference MUST reach a group-endorsed opinion.

Note: Your instructions may or may not be the same as those of others in the conference

In this and the other conferences, have fun! Do your best to adhere to the spirit of the procedures and rules since their purpose is to make our experimental results (hence our efforts) meaningful.

Conference II: An Occupational Decision

** Deadline: Monday, March 10, Noontime **

John is a friend of yours on the network. He is married, has one child, and is a systems programmer at a large, solid, "Fortune 500" manufacturing firm. He has been working with the same company since he graduated from college five years ago. With this company, he is assured of a lifetime job yielding a modest though adequate salary and a liberal pension upon retirement. Currently, he is earning $38,000. Corporate salaries keep up with inflation and increase slowly with seniority.

While attending the annual ACM meeting, John was offered a job with a small, newly founded company. The job would pay more than his present job. Also, if the company survives competition with larger firms, John would share in its ownership. But who can tell if the new concern will succeed?

John's problem: What to do?

Your Instructions:

A number of you on the network, also in computing, are personally interested in this dilemma because you feel that the same kind of choice could someday confront you.

Recognizing that if the new company makes it, it could make it big (e.g. Microsoft style); you realize that the problem reduces to a subjective decision:

How likely does success have to seem to make the change an acceptable risk?

1 chance in 10
2 chances in 10
.
.
.
8 chances in 10
9 chances in 10
10 chances in 10

Or, should John refuse the new job regardless?

The goal of the conference is to reach an aggregate opinion.

Conference III: Formulating a Plan of Action

** Deadline: Monday, March 26, Noontime **

The CS Department this semester is leaning on instructors to bring overall class averages down to 2.5 (or lower). You worry that you might not receive the A or the B in Stix's CS202 that you were counting upon.

During the course of a computer conferencing exercise, a number of similarly concerned students began joking about swiping the final.

The more you thought about it, the more you became convinced that this would be a good solution to the grade problem. Evidently, a few of the others thought so too, and somehow or other you people decided to run your own conference with the objective of devising a fully workable plan to steal the CS202 final examination.

The conference is about to begin. You think it might be prudent to take advantage of the medium and keep your identity secret, just in case one of the others defects and reports the rest of you to the Dean. You, therefore, decide to adopt a conference "pen name" -- some pseudo initials.

Some Relevant Facts

1) Stix writes his finals at least a week in advance so that he can tell the class what to expect.

2) Stix Xeroxes the final himself on the machine in the CWP Faculty Center.

3) He stores the finals in his office, room 303 of the Faculty Center.

4) He never locks his desk or his files.

5) Sister Noreen Horan is his office-mate (hence keeps office hours in room 301 and has the room key).

6) Dietrich Fischer, who uses room 302, the "outer office," has a key to room 301.

7) The receptionist in the Faculty Center has a master key.

8) The cleaning people work in the Faculty Center from around 7 p.m. to 9 p.m. two or three evenings a week.

9) Stix sends a copy of the final, for the Department's file, to the CS Department's secretary at PUP. He also sends a copy to the CWP Dean of Studies.

The Adoption of Information Technology in Academic Settings

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ABSTRACT

The adoption and use of a computer conferencing system developed at the University of Guelph, CoSy, is examined in terms of three different user groups on campus: academics, administrators, and library personnel. Several hypotheses are examined with reference to (1) peer influence and individual adoption decision, (2) facilitating factors for implementation and resistance to adoption, and (3) computer literacy and user satisfaction. Based on a sample of 269 respondents out of 417 CoSy users, our data revealed that peer use did not influence the individual's frequency of use, however, a facilitative strategy for CoSy implementation resulted in less resistance for adoption. There was a positive relationship between user satisfaction and CoSy use, but computer literacy did not have a significant bearing on the adoption and continued use of CoSy.

Introduction

The management of information systems for rapid dissemination of current information is very often the most crucial aspect of a work organization. In order to have an effective information exchange system, it is important to understand those factors that may facilitate or hinder the communication processes, as well as the consequences of the machine-people interaction. An area of study that is gaining interest concerns the transfer and storage of information. As Naisbitt (1982) has argued, the electronic information retrieval system is becoming a critical factor for the success of many organizations in the market place.

As we experience the rapid developments in computer assisted communications systems, it will soon become apparent that there may be a "gap" between those who adopt the new technologies and those who do not. Very often, this will result in a communication breakdown or loss of exchange in information. This fact has been documented by Crozier (1970). Failure to adopt new technology can lead to premature obsolescence of any organization (Lynn, 1970). This premature obsolescence will especially be true in those organizations that specialize in high volume technical information such as in research, development, and marketing of new products.

In our paper, we address several issues associated with the adoption or non- adoption of a computer conferencing/communication system, CoSy, which was developed at the University of Guelph. For an overview on the development and early applications of CoSy, the reader is referred to a recent M.Sc. thesis by Van Duren (1986). In order to determine those factors that may facilitate the process of adoption of a technological innovation, we examined the following questions in our study: Who adopts CoSy?, Why was CoSy adopted?, and What factors facilitated or hindered the adoption of CoSy?

From the review of the literature (see James 1986), several hypotheses were advanced to examine the relationship between peer use and individual use of CoSy. First, it was hypothesized that peer use would have a positive relationship to an individual's frequency of use. The relationship between social contact, peer use, and the adoption of a given technology by the individual has been a subject of research for many years, for example, Beal and Bohlen (1957:5), Lionberger (1960:38), Rogers (1962:171), Marsh and Coleman (1956). More recently, Brochet (1985:82) discusses the influence of the "dominant personality" in computer conferencing and the consequential activity levels of other participants in a conference. Similarly, El Sawy (1985:131) views the implementation of information technologies as a "cultural infusion" process whereby a small group of identified individuals from an entire organization are chosen and trained to support the implementation and application of new information technology. This core group then facilitates the adoption process within the organization by becoming a resource person to other individuals. Huff and Munro (1985:336) also recount that during the evaluation of an electronic executive work station, discussion with peers within the organization and out-of-house took place. Among others, Lucas (1978:30) and Foster and Flynn (1984) have also identified the critical importance that management plays in facilitating the adoption and use of information technology.

Our second hypothesis examines the relationship between implementation procedures of electronic technology and the degree of resistance manifested by individuals who adopt CoSy. In managing the introduction of information technologies, several researchers have noted the critical importance of successfully introducing, implementing, and managing the new technology. Rogers (1962:171) states that the resistance to change is inversely related to the rate of adoption of a technological innovation. El Sawy (1985:135) also discusses several sources of potential resistance to the adoption and use of computer technology.

Implementation procedures to facilitate social change, that is, the adoption of an innovation, have been addressed by Zaltman and Duncan (1977) to account for, and to minimize, the various types of resistance to social change. They have noted that resistance to change may include several different types such as those occurring from social and cultural implications, organizational, and psychological factors. Elizur (1970:184) has argued that research on the introduction of computers in the work place has revealed resistance "not only by the rank and file employees, but also by the supervisors and middle management".

Our third hypothesis examines the relationship between user satisfaction, computer literacy, and the adoption of CoSy. Mason (1985:42) notes that "the consumer will demand security, privacy, convenience, reasonable cost, understandable information, and simplicity of use". Crawford (1982:5) also argues that "user satisfaction" is an important contributing factor to the successful introduction and maintenance of an electronic communication medium. Based on his earlier experience with ARPANET, he comments that:

> We severely underestimated the capacity constraints in several dimensions and brought on too many new users too early. The result for a period of several months was high frustration for all users because of poor response time, undue internode message delays, and even worse, low probability of access to the system during prime time.

Cross (1985:216) indicates that computer teleconferencing "will probably find converts among those people who are already familiar with computers and computer terminals". This view is supported by Harasim and Johnson (1985:47) who have also identified that computer literacy and typing ability are important factors that facilitate in the adoption of teleconferencing.

Research Methodology

For our research, we are primarily interested in CoSy users at the University of Guelph who were either academics, administrators or library personnel. Thus, the sampling universe was defined as all CoSy users found on line during the winter semester of 1986 at the University, and who were not members of the various private industries or governments using the computer system. This restriction also applied to other individuals such as graduate students, research assistants, and individuals specifically employed in the design and maintenance of the CoSy system.

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With reference to the statistical procedures employed in the "data analysis" section of this paper, it should be noted that the sample referred to in this paper is not a sample. Rather, the sample referred to is actually a census of CoSy users and not a sample. The reason for this distinction is that the researcher was able to employ a list of the "universe" of all CoSy users, rather than drawing a sample from the available population from a theoretical universe. The consequences of such a census is that the statistical parametric procedures are based upon inference. This consideration in the data analysis will not be addressed, however, it is brought to the reader's attention only for the purpose of cautioning the reader in interpreting the data presented.

The first step in our data collection was to obtain a complete listing of all CoSy participants on the system as of March 18, 1986. This list of approximately 1,200 individuals was obtained with a "show participants all" command. The names on the list was then cross-referenced with the 1985 University of Guelph Telephone Directory. This directory aided in identifying academics, administrative and library personnel on the CoSy system. Of the approximately 1,200 individuals on the system, 457 individuals were identified as fulfilling the sampling requirements, namely that they were either academic, administrative or library personnel on the CoSy system during the winter semester of 1986. Individuals employed in private industry, various governments or directly involved in the design and maintenance of the computer conferencing system were not eligible. A mailing list was then constructed.

A non-random pretest of the three occupational groups was then carried out. This pretest aided in identifying several short-comings of the survey questionnaire that were subsequently corrected.

A total blanket survey of all 457 individuals, excluding the pretest sample group, was carried out. The questionnaire employed for our research was based on the "Total Design Method" (TDM) as discussed by Dillman (1978). This method of survey questionnaire construction and implementation attempts to foster a high response rate by using several techniques specifically designed to maximize the rewards for an individual respondent and to minimize the social costs for the individual. For example, personalized letters and multiple mailings asking for assistance in completing the survey questionnaire were used.

Two weeks after mailing the introductory letter and questionnaire, a second letter was sent to those individuals who had failed to respond. On April 15, 1986, 223 letters asking for assistance in the research project were again mailed via campus mail. The second follow-up letter resulted in additional responses. Forty written or telephone replies were received which gave a variety of reasons for being unable to complete the questionnaire. They ranged from individuals being on sabbatical or on sick leave to no longer employed by the University of Guelph. More frequently, however, non- respondents reported that they were no longer on the computer system, and thus, unable to complete the survey questionnaire.

Data Analyses

A total of 269 individuals (58.8%) from a possible 457 individuals completed and returned the survey questionnaire after one follow-up mailing. Taking into account the additional 40 respondents who indicated their inability to complete the survey questionnaire, the response rate increased from 267/457 (58%) to 307/457 (73.6%).

The percentage of response varied within the three occupational groups. The responses ranged from a low of 41.8% (87/208) for academics to a high of 80.7% (42/52) for library personnel. Of the administrative personnel, 140 out of 197 (71%) responded to the survey questionnaire. Table 1 below illustrates our data.

Table 1
Distribution of Respondents by Various CoSy Users (N=269)

Academic		Administration		Library	
Chairmen/Deans	21	Managerial	58	Full librarian	20
Professor	16	Supervisory	20	Professional	6
Assoc. Prof.	25	Technical	21	Associate	3
Assist. Prof.	15	Clerical	26	Supervisory	7
Other	10	Other	15	Technical	1
				Clerical	2
				Other	3
Total	87		140		42

Source: David A. James (1986:68)

The frequency distribution of CoSy users by college is presented in Table 2. This frequency distribution includes both academics and administrative personnel. For instance, secretarial staff of a specific academic department at the University identified themselves as clerical (administration) while indicating a specific college of employment. This response by administrative personnel explains why the frequency of response for college affiliation exceeds that of actual academic respondents.

Table 2
Distribution of Respondents by College Affiliation

College	Percentage (N=116)
Arts	8.6%
Social Sciences	12.1
Family & Consumer Studies	13.8
Ontario Agricultural College	23.3
Ontario Veterinary College	6.9
Physical Science	4.3
Biological Science	8.6
Institute of Computer Science	6
Other	17.2
Total	100.0%

Source: David A. James (1986:69)

The distribution of CoSy respondents by college affiliation does not include those individuals who identified themselves solely as administrative or library personnel. The reader is cautioned that interpretation of this frequency distribution is limited to the frequency of use by college. The percentage given is for the total number of 116 respondents. It is not indicative of the percentage of use by size of department.

Why Adopt CoSy?

A variety of reasons were indicated for adopting CoSy. Of the six responses provided in the survey question, 43% (98) indicated that their primary reason for CoSy adoption was for electronic mail. Open and closed conferences were chosen by 18.9% (43) and 18% (41) of the respondents respectively. Information transfer was the fourth category chosen as the primary reason for adoption (12.3%) (28). Confidential conferences and the "other" category responses had 1.8% (4) and 6.1% (14) respectively. These figures are closely related to the actual present use of CoSy as shown in Table 3.

Table 3
Initial Reason for Adoption and Present Use of CoSy

Categories	Reason for Adoption (N=228)	Present Use (N=221)
Electronic Mail	43 %	48 %
Open Conferences	18.9	16.3
Closed Conferences	18	14.9
Confidential Conferences	1.8	.9
Information Transfer	12.3	31.1
Other	6.1	6.8
Total	100.0 %	100.0%

Source: David A. James (1986:70)

In comparing the responses from the question "What was your main reason for adopting CoSy?", and "I now use CoSy primarily for:", the distribution of responses are very similar except for information transfer. In comparing these responses, it would appear that individuals who did adopt the computer conferencing system did so for a specific purpose. The various reasons for the adoption of CoSy are given in Table 4 below.

Table 4
Reasons Aiding in the Adoption of CoSy

Factors Aiding Adoption (Total Comments=188)	Percentage of Citation
1. Need for communication	23.4%
2. Forced adoption	11.7
3. Interest in specific conferences	11.1
4. Peer influence (colleagues)	9.0
5. Hardware availability	7.4
6. Committee member	7.4
7. Job related	6.3
8. Avoid telephone tag	4.2
9. Economic funding considerations	2.1
10. Use by others	2.1
11. Potential use	1.0
12. None	1.0
13. Sabbatical leave	.5
14. Other reason(s)	13.2
	100.0%

Source: David A. James (1986:72)

Of the 174 respondents who provided reasons for the adoption of CoSy, 23.4 percent stated that the primary reason was based on the need for communication with others. Specific examples of these responses were as follows:

- I needed a way to communicate with a research team located across Canada. CoSy had been introduced a few months earlier and it met my immediate requirements.

- Need to communicate in conversations and have access to electronic mail, especially from remote locations.

- A need to communicate with someone at UBC/U Vic. who was on system.

- Possibility of communicating with others both on and off campus. Tele-conferencing with those at different locations.

- Only conference system available. Promise of all encompassing tool for office communication.

- Wanted a conference system that was being used across campus.

Other reasons most commonly cited for the adoption of CoSy were the following:

- First attempt to become computer literate.

- I enjoy trying out new ideas in the communication area.

- Part of education.

- Personal shame, curiosity.

- My understanding of where the world is going.

- It is an essential adjunct to the university process.

- No mad CoSy users.

- Have not at this point, although I signed on and used it initially.

An important factor that eventually lead to the adoption of CoSy for many users was "forced adoption". The administrative decree to join CoSy, excluding the encouragement of academic colleagues, ranged in intensity from simple requests to demands by various superiors. The following comments summarize the different degrees of influence exerted upon specific individuals to adopt CoSy.

- Office of research requested it.

- Part of my job.

- Director suggested joining.

- Asked to use it by management.

- Dean required it.

- Dean decided we should be on it.

- Superiors requested it.

- Director insisted.

- My superior said I had no choice.

- My boss said I had to use it with interdepartmental communication.

- It was do or die as all were using CoSy, so I had to learn.

- Management decree.

- None. - It was forced.

Interest in monitoring or participating in specific conferences was another important reason for adopting CoSy. This was cited by 21 individuals or 12% of the respondents who replied. The following responses represent the comments categorized as "Interest in specific conferences":

- Conference I wanted to participate in.

- Hope to network because of co-worker at Cornell.

- I was being left out of some conversations.

- On going conference in my area of interest.

Peer influence as a reason for CoSy adoption was cited by 17 individuals. Examples are as follows:

- Colleagues use CoSy.

- Other members of department are on CoSy.

- Enthusiastic staff and colleagues.
- Peer pressure.
- Colleague's support.
- Personal shame, curiosity.

Hardware availability and committee responsibilities also influenced CoSy adoption. Both of these factors were cited by 14 individuals and represented 7.4 percent of the total comments made. Hardware availability was summarized by the respondents as present, and therefore, utilizable. Similarly, committee membership responsibilities forced 14 individuals to adopt CoSy out of responsibilities to the committee. This forced adoption by individuals is clearly evident by the following comments:

- Forced to participate as part of committee work.
- Necessary because of appointment to committee which used conferencing.
- Necessary for certain aspects of my work (ie. committee conferences).
- I was part of a conference, department representative for computer technology.
- A committee decided to use it.

A variety of other reasons were identified as significant contributing factors for the adoption of CoSy. These reasons are self-explanatory, and therefore, will not be discussed in detail. These are as follows: job related, avoid telephone tag, economic funding (grants), use by others, and potential uses.

Factors Hindering the Adoption of CoSy

To the question, "What reasons hindered you in your decision to adopt CoSy", 158 individuals (59%) responded. A summary of reasons that hindered the adoption of CoSy are given in Table 5 below.

Table 5
Factors Hindering the Adoption of CoSy

Hindering Factors	Percentage of Citation (Total Comments 188)
1. Hardware limitations	26.7%
2. Training	14.7
3. No perceived need	12
4. None	8.7
5. Manual	7.1
6. Software limitations	6.5
7. Personal time restrictions	4.9
8. Editor	4.9
9. Economic costs	2.2
10. Computer illiterate	1.6
11. Non-typist	8.7
	100.0 %

Source: David A. James (1986:76)

In reviewing the comments solicited on hindrance for the adoption of CoSy, a variety of factors were identified. The first factor identified by 49 individuals from a total of 158 respondents indicated a lack of appropriate hardware. This source of hindrance represented 26.7% of the comments given by the respondents. Examples of such comments are as follows:

- Lack of hardware! Reluctant to use someone else's office. Still no hardware in my office -- don't want to bother others.
- Restricted equipment facilities.
- Lack of hardware in my office, specifically access to a Gandalf or modem.
- Difficulty in getting hardware connection (budget) to my personal micro.
- The cost of linking up = $300, for a special line.
- Not being hooked up to a line personally. I have to use my bosses -- only time permitted is between meetings or on lunch break.
- Lack of hardware -- but most especially, need to pay $500 - $600 for Gandalf line.

The second hindering factor identified in the adoption of CoSy was the lack of training given to new users of the system. This source of resistance to adoption was cited by 27 individuals out of the 158 who responded to the question. Several comments related to the lack of training are as follows:

- Lack of training.
- Training.
- Lack of proper training, I started on a trial and error basis until I had help.

- The training is not consistent and the manual is not clear, it wanders from mail to conferences and around.

- Instructions on usage.

- Training not very good. Use of CoSy on our hardware is awkward.

- Inadequate training, trivial messages.

- Lack of initial training and guidelines by my department.

The third factor that negatively influenced the adoption of CoSy was the lack of a perceived need for the computer conferencing system. A total of 22 respondents identified this factor as the primary reason for not adopting CoSy. These individuals represent 13.9% of the total 158 individuals who responded to the question. A selection of these comments are as follows:

- Don't need it very often.

- Need -- Did not require, use very little.

- No need.

- I didn't see a use for it until I was working with someone across campus who was using it and I decided it was the way to get messages back and forth.

- I was actively using CMS mail and also used CMS extensively. I was reluctant to use a different operating system for mail/conferencing.

- Was using APL and CMS mail systems.

- Didn't see how it could help.

- Used primarily as a message medium among staff -- No longer applicable and no other use has yet been determined for it to be needed.

A variety of responses that were not readily codable were categorized as "other". This fourth category comprised of 16 individuals or 10.1% of the respondents. These respondents cited various reasons that hindered the adoption of CoSy as follows:

- Phone was quicker and easier.

- The number of messages that are irrelevant and time consuming to read, the fact that leaving a phone message was just as fast and omitted the "games" and the fast mail service on campus.

- Laziness to learn new system.

- We receive very few messages on it, so as a result we are not in the habit of using it.

- I'm hesitant to rely on it 100% because sometimes messages are lost or distorted. I like "hard-copy" for files.

- I still appreciate "face to face" discussions on some of the topics being used in CoSy. I also hate typing.

- There is a lot of garbage amongst the good stuff.

- Not enough others are using it at the time or before it to be efficient for communicating with the group that I needed. This has changed now.

A variety of other factors were also identified by the respondents as hindering the adoption of CoSy. They will not be discussed in detail as they are self-explanatory, however, they will be examined. Of the 158 individuals, 16 stated no source of hindrance in their attempt to adopt CoSy. This group represents 10.1 percent of the respondents answering this question.

A total of 13 individuals or 7.1% of the respondents noted that an unsatisfactory manual was a hindrance in adopting Cosy. Comments ranged from "poorly laid out manual" to "poor documentation, poor documentation, poor documentation".

Similarly, limitations in the actual CoSy system itself were expressed by 12 individuals, representing 6.5% of the respondents. The various comments noted issues such as:

- 1) Verbose and quiet editor have different command sets. 2) Datapack interface hangs every 256 characters.

- Unfriendliness of the system.

- Inefficiencies in early version re access to longer sequence of commands, inability to record portions of text.

- Slow response time. Loss of data and other technical difficulties. Lack of response from system manager.

- Ease of use.

Other factors identified as sources of hindrance in the adoption of CoSy were: personal time restrictions (9 individuals), a limited line editor (9 individuals) and a fear of economic costs involved in the use of CoSy. Two remaining issues cited by respondents were computer illiteracy and the inability to type. Both categories had 3 individuals each from our total of 158 respondents.

The final observation to be drawn to the reader's attention relates to the low response rate regarding the economic costs of the system. Although only 4 (2.2%) individuals identified this as a source of restriction, 49 individuals (26.7%) identified the lack of available hardware. These hardware limitations are a result of limited financial resources available for the acquisition of new equipment.

Additional comments about CoSy provided by the respondents yielded the richest qualitative source of data. These comments are summarized below and are of significance in that they provide a wide range of important topics for future discussion. These comments also offer the reader a "feeling" of the diversity of attitudes of CoSy users. The comments are presented in a random fashion as follows:

- CoSy is a useful tool for conferences but the awkward editor detracts from it. One has only to look at the garbage in any conference to realize that people cannot bother to use the editor to make corrections. As far as mail goes, CoSy is primitive compared to CMS mail and is counter productive.

- CoSy mail is inadequate -- No file system! CoSy is too isolated from network of other computing environments. CoSy makes it very hard to find interesting conferences. It has no BOOLEAN keyboard search facility. CoSy editor is awful. CoSy needs a voting system.

- The utility of a system like CoSy depends much on having a critical mass of users. I think that such a critical mass is now established at the university and that CoSy has become a useful tool to both educators and administrators, I can't answer for students.

- The basic difficulty I have with the use of electronic mail results from those listed not signing on the system on a regular basis to read their mail resulting in delays. There isn't much use having faculty members on CoSy if they don't use it. It is great for answering letters when the people involved are active users.

- Your study seems predicated on the assumption that CoSy is great, everybody loves it, etc. My view is that it is waste of the University's resources. When I tried it, I found that it encouraged people to express all kinds of stupid and trivial remarks that would not find their way into traditional hard-copy memos, or face to face conversations. This wastes my time and mental energy.

- I should say: I "joined" CoSy conferences out of curiosity. After a couple of weeks I decided it wasn't worth the time and effort. I've not signed on for months, and probably will not again.

- Improvements in technology do nothing to improve the content of the communication. In some ways it is worse because those with little to say on a topic have the ability to reach the same potential audience, as those who have something to contribute. Each user has to find a way to filter out the garbage and resist the temptation to contribute to it.

  The problem with CoSy is that it is archaic in its user interface.-- Why anyone would still use a line editor today is incomprehensible. The manual is almost next to useless -- if you can't find someone who knows how to get a function performed you have to experiment and waste your time finding out what the manual didn't cover. I would state that for most people, on campus mail is 10 times more efficient.

The frequency of CoSy use as measured by the number of times a respondent signs onto CoSy was also examined. A total of 251 individuals (94%) responded to this question. The distribution for frequency of use, as noted by the number of times an individual signs onto CoSy per day, is presented below in Table 6.

Table 6
Frequency of Use by Contacts

Number of Sign-ons	Percentage (N=251)
Less than once per day	43.4 %
1 per day	22.7
2 per day	21.1
3 per day	8.3
4 per day	2.3
5 per day	1.7
6 or more	.0003
Total	100 %

Source: David A. James (1986:83)

Of the 251 respondents, a total of 109 individuals (43.4%) indicated that they initiated contact with the computer conferencing system less than once per day. In contrast, 110 individuals (43.8%) indicated signing-on "CoSy" once or twice per day. The percentage of CoSy users who initiated contact with the computer conference system more than three times per day is substantially reduced to 21 or 8.3 percent of the CoSy user population. A remaining eleven individuals (4%) account for the high frequency of daily use of at least four contacts per day with CoSy.

The actual use of CoSy was also measured by the number of CoSy messages received per day. The number of messages received by the respondents ranged from less than one per day to forty. A total of 52.1 (139) percent received less than one CoSy message per day. The remaining 47.9% (128) who received one or more messages per day averaged 5.68 messages. The standard deviation for this group was 6.19.

Time spent on CoSy, in minutes per session, was also measured in the survey questionnaire. Time on CoSy varied greatly from 1 minute to 45 minutes. A mean of 9.96 minutes for the total group was obtained with a standard deviation of 7.59. A total of 247 (92.59%) responded to this question.

Computer literacy was determined by the number of computer languages an individual identified as being familiar with. From the total of 269 respondents, 205 (76.2%) respondents indicated that they were familiar with one or more computer languages or computer packages. The number of languages known ranged from one to nine or more.

Table 7 compares the activity levels for open conferences by the three user groups. Of the academics, 6.3% indicated that they were "very active" in open conferences as compared to 3.1% for both administrative and library personnel. However, 25% of the librarians indicated that they were "active" in comparison to 22.9% and 17.7% for academic and administrative personnel respectively. Both administrative and library personnel indicated that 43.8% were "neutral" in their level of activity in open conferences; whereas 18.8% of the academics indicated that they were "very inactive". In comparison, 16.7% and 15.6% of administrative and library personnel respectively were "very inactive".

Table 7
Open Conference Activity Level by User Groups

Activity Level	Academics (N=48)	Administration (N=97)	Library (N=32)
Very Active	6.3%	3.1%	3.1%
Active	22.9	17.7	25
Neutral	25	43.8	43.8
Inactive	27.1	18.8	12.5
Very Inactive	18.8	16.7	15.6
	100	100	100

Source: David A. James (1986:86)

The activity level of closed conferences for each user group is summarized in Table 8. Library personnel were again the most active users of the closed conference function of CoSy. Of the library personnel, 30.8% indicated that they were "very active" in using the closed conference. In sharp contrast, only 14.7% and 3.1% of academics and administrative personnel respectively utilized this specific aspect of CoSy. The "very inactive" pattern of use for closed conferences were 3.8% for library personnel, 11.8% for academics, and 16.7% for administrative personnel.

Table 8
Closed Conference Activity Level by User Groups

Activity Level	Academic (N=32)	Administration (N=75)	Library (N=26)
Very Active	14.7%	3.1%	30.8%
Active	41.2	17.7	50
Neutral	17.6	43.8	15.4
Inactive	14.7	18.8	0
Very Inactive	11.8	16.7	3.8
	100	100	100

Source: David A. James (1986:88)

Table 9 summarizes the activity levels for confidential conferences for the three user groups. The library personnel are the most active users of CoSy for confidential conferences, with 68.75% of this group indicating that they were "very active". This percentage of use is in sharp contrast to only 36.1% for administration, and 14.28% for academics. This pattern of activity is further substantiated by the inactivity data for these three user groups. Only 6.25% of the library personnel indicated that they were "very inactive" in confidential conferences as compared to 13.9% for administration and 28.5% for academics.

Table 9
Confidential Conference Activity Level by User Groups

Activity Level	Academic (N=14)	Administration (N=33)	Library (N=16)
Very Active	14.28%	36.1%	68.75%
Active	42.28	25	18.75
Neutral	14.28	13.9	46.25
Inactive	0	11.1	0
Very Inactive	28.57	13.9	6.25
	100	100	100

Source: David A. James (1986:89)

In order to understand the substantial differences in activity levels by the three occupational groups, the historical aspects of electronic conferencing systems on campus must be considered. The library staff who are so strongly committed to using CoSy have had previous exposure to other similar systems. Ellen Pearson (1985:168) Associate Librarian, Information Services, at the University of Guelph, recounts that during the INet field trials (an electronic mail system), library Division heads became committed electronic mail users.

Table 10 summarizes the previous exposure individual CoSy users have had to electronic conferencing systems. This table indicates that 53% of administrative personnel have had experience with various electronic communication mediums. Of these individuals, the number of different types of systems ranged from one to six. Library personnel also indicated considerable experience with 46.3% indicating that they had previously used an electronic communication medium. The number of systems previously used by library staff ranged from one to eight. Academics indicated that they had the least experience (24.7%) with electronic communication systems. Of these individuals, the range of systems previously used was one to four.

Table 10
Previous Use of Electronic Conferencing Systems by User Groups

Response	Academics (N=81)	Administration (134)	Library (N=41)
Yes	24.7%	53%	46.3%
No	75.3	47	53.7
	100	100	100
Range	(1-4)	(1-6)	(1-8)

Source: David A. James (1986:91)

Individuals responding to the statement, "My peers were useful in helping me become familiar with the CoSy system", is provided in Table 11.

Table 11
Peer Support by User Groups

Level of Agreement	Academics (N=82)	Administration (N=39)	Library (N=42)	Total (N=263)
Agree	60.9%	74.3%	91%	72.6%
Disagree	39.1	25.7	9	27.4
	100	100	100	100

Source: David A. James (1986:100)

This table indicates that 91% of library personnel agreed with this statement in comparison to administrative personnel and academics with 74.3% and 60.9% in agreement respectively. Disagreement with this statement was strongest for academics with 39.1%, in comparison to 25.7% for administration and 9% for library personnel. Of 263 respondents to the question, 72.6% agreed with the statement in contrast to 27.4% in disagreement.

Response to the statement, "My departmental office staff was useful in helping me become familiar with the CoSy system", are summarized in Table 12.

Table 12
Departmental Help by User Groups

Level of Agreement	Academics (N=79)	Administration (N=135)	Library (N=39)	Total (N=253)
Agree	34.9%	44.7%	64.2%	43.2%
Disagree	65.1	55.3	35.8	56.8
	100	100	100	100

Source: David A. James (1986:101)

Of the library personnel, 64.2% agreed with this statement. In comparison, 44.7% of administration and 34.9% of academics agreed respectively. Of the total 253 respondents, 43.2% agreed with the above statement. Disagreement with the statement was strongest for academics with 65.1% in disagreement compared to 55.3% administrative and 35.8% library personnel who disagreed.

Table 13 summarizes the results of the statement, "I am satisfied with the CoSy system". Of the library personnel, 85.7% agreed with the statement and 84.1% of the administration. Of the academics, 76.4% were in agreement with the statement. Disagreement was strongest with academics at 23.6%, followed by the administration and library personnel with 15.9% and 14.3% disagreement respectively. A total of 260 individuals responded to this question. Of the total, 82.1% were satisfied with the CoSy system.

Table 13
Satisfaction with CoSy by User Groups

Level of Agreement	Academics (N=83)	Administration (N=136)	Library (N=41)	Total (N=236)
Agree	76.4%	84.1%	85.7%	82.1%
Disagree	23.6	15.9	14.3	17.9
	100	100	100	100

Source: David A. James (1986:104)

Findings

Reasons for the adoption and actual use of the conferencing system were very similar for the three user groups studied. The principle reason for adopting CoSy was for electronic mail, with 43% of the respondents indicating this as their primary reason; actual use is slightly higher at 48%. The main purposes for the adoption of the three types of conferencing, namely, open, closed, and confidential, closely coincided with the actual present use of CoSy with only a slight variation. The only substantial difference between the purpose of adoption and actual use is found in "information transfer". Only 12.3% of the respondents originally indicated this as a purpose for adoption, however, in actuality, 31.1% indicated that this function was of primary importance at present.

Factors that aided in the adoption of CoSy consisted of: 1) need to communicate (23.4%), 2) forced adoption (11.7%), 3) interest in a specific conference (11.1%), and 4) peer influence (9%).

Hindering factors that retarded the actual adoption and use of CoSy were primarily identified as: 1) hardware limitations (26.7%), 2) training (14.7%), and; 3) no perceived need (12%).

The three hypotheses tested in this research will now be discussed. Our first hypothesis noted that peer use will have a positive relationship to an individual;s frequency of use. Peer use was determined as the percentage of individuals in the respondent's department or office who use CoSy. The frequency of use was determined using three questions. The first question determined the number of contacts (sign-ons) made by the respondent; the second, the number of messages received by that individual on CoSy, and third, the actual time in minutes, spent on the system. A Pearson product moment correlation was calculated between peer use and the three measurements of CoSy use. Our first hypothesis was not supported on the basis of our data.

Our second hypothesis postulated that there is an inverse relationship between positive implementation procedures and the degree of resistance to the adoption at the individual level of analysis. This positive implementation procedure was measured as the number of learning sessions an individual received regarding the introduction of CoSy. The degree of resistance was measured on a Likert scale item addressing the apprehensiveness of the individual's use of CoSy. Our second hypothesis was supported in the data analysis.

The third hypothesis tested the relationship of user satisfaction, competence, and computer literacy to CoSy adoption. Our data analyses yielded several relationships that indicated positive relationships for user satisfaction, competency, and CoSy use. Computer literacy, however, showed no indication of being a significant contributing factor to the adoption and continued use of CoSy. This hypothesis was unsupported in the data analyses.

In conclusion, several recommendations can be advanced in order to enhance the adoption and continued use of CoSy. These recommendations have been substantiated by other researchers. For example, Roberts (1984) advanced the following recommendations that are applicable for a successful implementation and use of a computer conferencing system:

1) Encourage people to practice, like driver education,

2) Develop a "buddy" system to share ideas, give support,

3) Develop a system to overcome the fear of typing,

4) Establish a communications protocol - who speaks and when,

5) Eliminate grammar/typographical issues -- encourage the participation of all than from only those who are English professors, and,

6) Establish separate discussions pertaining to desired communication formats.

Crawford (1982) suggests a variety of other recommendations to aid in the successful implementation and management of a computer mediated communication system.

1) Develop a telephone hot-line to help new users of the system,

2) On screen self-help aids should be simple and direct,

3) Short formal courses should be designed to aid in the orientation for the new users,

4) Specifically tailored tutoring sessions for specific user groups eliminate or reduce problems of resistance,

5) Establish a departmental technical support staff for training and resource person, and,

6) Establish and maintain an adequate "service level" for the users of the system.

Various authors have presented research findings directly related to the design, implementation, and use of CoSy. These recommendations will now be examined.

The first attempt to assist the novice CoSy user originated in the preliminary design of the conference system. Mayer (1985:23) states that among the various goals of CoSy was that it be "learnable without recourse to a manual." Expanding on the primary goals of this design system were:

1) ease of learning, ideally without recourse to a manual,

2) ease of use, minimizing unnecessary typing,

3) not tedious, repetitive displays should be minimized, and

4) robustness, the system should insulate the user from the underlying operating system and provide guidance in case of errors.

Brochet (1985:81-83) also identifies specific recommendations for CoSy to ensure enthusiastic user acceptance. These recommendations will now be briefly stated. For a full discussion of these recommendations, the reader is referred to Brochet (1985).

1) A professional, well organized introductory tutorial replace the standard manual for intro training,

2) The registration of new "participants in a conference should take place at the same time; no one should be `left out' for several weeks of a conference, especially a short-term conference",

3) Access to terminals is needed "if one is looking for a uniform level of acceptance; it is essential that a uniform level of access be provided to participants", and

4) The role of the conference moderator must be well defined for the conference participants, so that the moderator can be most effective in achieving the goals of the conference,

5) "The role that participants play in a conference is also a topic that should be discussed as the conference gets underway, especially in situations where people are using the system for the first time", and

6) The role of observers in a conference should also be discussed early in a conference, for "it is important for the group to know who the observer is, what role that observer plays in relation to the other group members and to themselves".

For the most satisfactory and continued use of a computer mediated communication system, the primary concern should not be with the day to day activities of such a system, but rather, with the longterm goals and objectives of such a system. These goals are perhaps best summarized by Olson (1982:90) who stated that:

> The challenge of management in the future, beginning today, is to utilize the vast potential of computer and communications technology to achieve the end of increasing organizational productivity while at the same time improving the quality of work life for all employees.

The following recommendations have been derived from our research data. These recommendations are presented to assist in the identification of possible strategies to aid in the continued development and use of CoSy.

The first recommendation addresses the role and function of a social change agent in the adoption of new technologies. Zaltman and Duncan (1977) discuss this important role in maximizing the positive effects of the planned social change intervention. Similarly, negative consequences of introducing the planned program must also be considered. Our data provides considerable evidence that indicates poor planning at the social level of implementation in some departments. Instead of nurturing the adoption and development of CoSy use, forced strategies for adoption were implemented. This strategy of forced adoption hindered the actual process of adoption and use of CoSy.

The eventual adoption and use of CoSy was also hindered by a lack of introductory training and by the use of an inadequate manual. This manual, although not critical to many experienced users, requires further elaboration and updated information for the inexperienced CoSy user.

Tutorials for inexperienced CoSy users would also seem warranted since many of the special features of the system are unknown. These learning sessions could be structured to aid new comers to the system. More experienced users may also benefit if exposed to advanced tutorials.

Limited access to appropriate hardware faced by faculty and staff must also be addressed. These limitations, based primarily on economic considerations, will continue to hinder the successful adoption of CoSy, if inaccessibility to the system persists.

A newsletter for CoSy users to provide general systems information may be one possible method of promoting CoSy use. This forum could be used to announce new technical features of the CoSy system or to broadly address various issues of user concern. This newsletter may also enable those individuals connected to the system, but who use the system very sporadically, to be kept informed of design changes.

A major concern often raised by CoSy participants is the role of the moderator. It would appear that participants in a CoSy conference expect moderators to actively participate in the conference by enforcing or maintaining a certain level of relevance and standard to the conference topic. Many respondents of our survey have expressed concern over the amount of "garbage" in conferences and the need to limit this type of non-productive information.

The final recommendation to be made in this paper concerns the security of the system itself. A number of individuals who appear on the CoSy participants listing are in fact no longer with the University of Guelph. University of Guelph personnel who leave the University community should be removed from the system, thus ensuring a more secure system.

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COMPUTER CONFERENCING APPLICATIONS

Supporting Secondary Science Teachers: The Role of Common Interests

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ABSTRACT

In a conference designed for collegial exchange and support, 75 science teachers tended to make requests and replies on rather discrete points of science and science teaching, rather than engaging in discussions. Their reliance on specific common interests may be related to their lack of acquaintanceship and to the nature of the medium. If so, small conferences for support of unacquainted professionals may want to insure a base of common interests through narrowing topical focus or introducing collaborative activities.

INTRODUCTION

Research on the uses of computer-based conferencing has recently sought to identify the combinations of social, topical and technical features that lead to successful conferences. Our own experiment with a conference of 75 volunteering secondary science teachers designed for collegial exchange and support has led us to sense a dilemma which we would like to explore in this paper. We ask, is there a correlation between specificity of information interests and lack of previous acquaintanceship with other participants, which has policy implications for the design of small conferences aiming to promote interpersonal engagement in groups of unacquainted professionals?

THE ETC SCIENCE TEACHERS' NETWORK

The network was run on an ETC-designed system called Common Ground, described in the December 1985 issue of Byte magazine. To minimize expense to potential school users, it runs on a microcomputer; it is also designed to facilitate discussion among an enrolled membership, and to allow collection of data on all reading and writing acts.

Science teachers from eastern Massachusetts were invited to join for purposes of "collegial exchange", as were several scientists and science educators who were suggested by member surveys. Members provided their own equipment and phone costs. About one third of members had a computer at home and had no significant phone costs, the remainder had less convenient access. About 40% used a school computer; for many of these, it was hard to schedule time to log in during the school day.

The network was run by two psychologists including a staff development specialist, and four teachers, who provided social and technical facilitation. Topical divisions of the conference were established by staff according to teachers' suggestions and staff judgement, and included: a "forum" in each teaching subject (chemistry, physics, biology, earth science), and several of general interest (a biography forum for members to describe their background and interests, a notice board, calendar of events, a forum for technical information on conferencing, on educational software, for literature review, and for discussions with two particular guests).

The host machine collected records of log in dates and durations, who wrote what to whom, and who read what messages. Because we were interested to know whether, as Crook (1985) suggested, information exchange might follow channels of pre-exisiting relationships, we surveyed the degree of previous acquaintance of each member with every other member. In addition, we surveyed teaching areas and experience, and conducted interviews with most teachers about their professional interests and experience with the network.

PARTICIPATION

The network membership grew gradually from December to June 1986, reaching 75 teachers, 60% of whom became continuing users. About a quarter of all users, or about half of continuing users, logged in at a rate of once a week or more often. Login pattern varied widely, from discontinuation after a few sessions to regular and frequent logging in. Data on message reading show that half of the continuing users read all forums; 60% read all messages in their teaching area, and 80% read at least half of these. Amount of writing varied, but averaged one message per week among continuing users.

The general usefulness of the conference for reducing professional isolation was shown in that the more isolated teachers engaged in more reading and public writing. Although the total amount of writing (public and private) of members was correlated with the number of persons known previously through face-to-face interactions, the channeling of information was not limited to pre-exisiting relationships: the majority of teachers addressed messages more or less equally to known and unknown individuals. The study is fully reported in Katz, McSwiney and Stroud (1987).

THE ROLE OF SPECIFIC COMMON INTERESTS

Our question about the role of specific common interests in the development of a conference, however, derives from two principle observations of the network: (1) common interest in specific information appeared critical to teachers' use and concepts of the usefulness of the network; and (2) as others have noted, the nature of the medium leads to temporal fragmentation of discussions, and some topics may be more amenable to this than others. These observations led to further questions that we were not able to answer in last year's research.

Concerning the first point, three kinds of evidence suggested that unacquainted members need to be able to talk about specific information: (a) the members, who were mostly unacquainted with each other and new to conferencing, tended to exchange messages at first about relatively discrete points of information, and only with experience, to offer personal views or discussion of more abstract points; (b) the concepts of network use that teachers spontaneously offered in interviews also revealed interest in obtaining specific information; and (c) responding to questions about specific information was the kind of exchange that began interactions between unacquainted teachers.

These data imply that establishing participation requires a minimum level of interest and knowledge on specific topics. It may seem self-evident that for a group of people to want to interact with each other in any medium, they must hold some interest in common that they can interact about. Furthermore, a specific topic -- one those boundaries and parts are clear to participants -- may be especially important for unacquainted persons to be able to interact without confusion. In any medium, in maintaining a continuing interaction, the need for a very specific topic may decrease as participants become better acquainted. As acquaintanceship develops, participants have learned how to talk with each other and can begin to explore less well-defined topics of common interest.

In electronic conferencing, however, last year's ETC study of science teachers, as well as other conferencing research suggest that specific common interests play a larger part in determining whether social interactions develop than in face-to-face situations. In electronic conferencing, readers scan over numerous messages and respond to the message content that interests them. The choice of to whom to respond cannot be guided by either spatial proximity or visual information about others (Kiesler, Siegel & McGuire, 1984). But in a review of a variety of mainframe conferences, Kerr and Hiltz (1982) list reliance on message content as a characteristic of new users in particular, relating this to their lack of knowing how to communicate when visual cues are absent. If the goal if a teachers' conference (in contrast with an electronic bulletin board) is interaction that will lead to mutual engagement to inform and vitalize practice, it is all the more important that topics exist that can bring participants together -- topics for which participants have both interest and knowledge. Last year we were not able to learn whether teachers' reticence or reliance on discrete information would change with greater acquaintanceship or with more experience using the medium because there was not enough variation in these among the members. Most teachers had never met; only 10% of teachers had conversed face-to-face with more than four other members. Furthermore, many of the teachers did not participate often enough to build up comfort using the system. Yet within the membership, amount of writing was positively correlated with number of persons known through face-to-face interactions.

We wonder whether our teachers' reliance on specific common interests was a way of adapting to the temporal fragmentation of exchanges in asynchronous computer-based conferencing. Scollon (1983) has noted the paradox that, although messages are available to their audience almost as soon as they are written, it seems that computer conferencing is more effective for interactions that are less time-dependent. Certainly a conference aimed at information exchange, but which has no facility for accessing information databases on the topic of interest, cannot be used for information that is needed immediately because one cannot predict the likelihood or time that members will be able to provide this information. Also, members read different segments of the stream of messages at a time, so that, if a discussion has evolved, members may experience it quite differently.

A better understanding of the role a common interests in promoting interactions may dictate choices of purpose and design of "support"-oriented conferences. It appears that the particular configuration of several variables -- stated conference topics, diversity of members' interests, and degree of previous acquaintanceship -- together with some technical features of the conferencing system which dictate how people read and write on it, may lead a conference to succeed or fail. For example, a small unacquainted group with diverse interests and a broad network topic is likely to fail because the probability of members' finding messages on their specific interests is too low. A larger such network may succeed, but since the frequency of log-ins will probably vary, this network cannot be used for information that is needed urgently. Knowing whether previous acquaintanceship is inversely related to degree of specific common interests in evoking members' responses directs decisions about whether, for example, arrangements should be made for face-to-face gatherings, or instead to increasing the membership. Finally, the strongest means to pull members into interactions would be a common task which cannot be carried out except over the network. Here the task itself would structure log-in pattern and content of discussions. Therefore, where a network aims to promote discussion of practice among unacquainted persons, it may be best to maximize the degree of common interests among participants by either limiting topical focus or introducing collaborative activities.

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The Use of Data-Conferencing as an Instructional Technique

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ABSTRACT

During 1985, the Canadian Medical Association (CMA) and Telecom Canada co-sponsored an 8-month trial of the iNet 2000 electronic gateway. During the trial, 22 physicians and two pharmacists in 14 settings were provided with Bell Displayphone terminals and access to online information retrieval systems such as the American Medical Association's MINET and Bibliographic Retrieval Services (BRS). BRS contains MEDLINE, HEALTHLINE, and other major databases. During the trial, it soon became evident that the participants would require ongoing training and support to use the online systems effectively. This paper reports on training efforts that were undertaken using a combined teleconference and dataconference. In this session, the instructor discussed the techniques of searching online databases via the teleconference link. At the same time, the participating sites were able to monitor the instructor's online demonstrations using the data-conferencing facility of the iNet gateway. Follow- up evaluation showed that the participants found the session helpful and that subsequent use of the online systems was increased.

ONLINE DATABASES

Online databases currently provide practising professionals with access to a range of bibliographic and full- text information that can be helpful in solving specific work- related problems. The same systems can be used as a means of keeping up-to-date with new developments. Database vendors are now encouraging direct use of these online systems by professionals, since microcomputers and modems are becoming widely available in work settings. This represents a major departure from past practice. Searches of MEDLINE, the computerized version of the printed Index Medicus, have previously been performed for physicians mainly through libraries where trained search intermediaries are on staff. As more practising professionals begin to use online databases directly, there will be a need to develop innovative methods of training and supporting so-called "end users". This paper reports on training efforts that were undertaken as part of a trial of online biomedical databases in Canada.

THE CMA iNet TRIAL

The CMA iNet trial was jointly sponsored by the Canadian Medical Association and Telecom Canada to provide physicians in practice settings with access to online information systems, such as the American Medical Association's Medical Information Network (MINET) and BRS Information Technologies. BRS contains MEDLINE, HEALTHLINE, and other major biomedical databases. The contents of the databases include bibliographic information, such as the author, title, and source of the original articles and books, as well as full-text information from selected biomedical journals and major medical texts.

These databases were accessed through Telecom Canada's iNet 2000 system, which acts as a centralized electronic gateway to database services in many different fields. In addition to databases, iNet offers many other powerful computer-based services, such as directories of online files by subject, ENVOY electronic mail, the ability to monitor searches done on other terminals, and downloading of records into iNet for editing and possibly forwarding to other gateway users.

The goal of the CMA iNet trial was to assess the usefulness of online medical databases to practising physicians. End-user access could greatly increase the availability and volume of database searching. The CMA Council on Medical Education thought that the content, modes of access, and cost- benefit of these services should be investigated through a trial. The proliferation of new databases, as well as the variety of search systems and gateways that are becoming available, make it increasingly difficult for the individual physician to understand and make an informed choice about using such services. The CMA sought to assess both the pros and cons of using online computer databases for different information needs in various types of practice settings. The results of the trial have been reported in detail elsewhere (Marshall, Banner, and Chouinard, 1986).

In the trial, 22 physicians and two pharmacists in 14 different practice settings were supplied with Bell Displayphones, printers, and an extra telephone line for databases access. The databases charges for the 8-month trial period were paid by CMA. The trial sites were widely dispersed geographically from British Columbia to Nova Scotia, which presented some challenging training problems. Hardware installation and training were the responsibility of Telecom Canada at the local level.

Although participants in the trial could access many different databases vendors in all subject fields through the iNet gateway, the major interest was in biomedical information. Special arrangements were made to obtain access to MINET, a system designed specifically for practitioners. Participants were brought together in Ottawa for one training session on MINET early in the trial, and the first first few months allowed them to focus on using the menu-based MINET as a way of acquainting themselves with online retrieval. MINET includes full-text drug and disease descriptions, a clinical literature database which contains references from 300 biomedical journals called EMPIRES, and an electronic mail and bulletin board service (MED/MAIL).

It soon became evident that the physicians wanted to access a more comprehensive database such as MEDLINE, which was available in the gateway through BRS. This access was provided, but the command-language software used by BRS was unlike the menu-driven MINET. At the time the project was set up, BRS/Saunders Colleague and BREAKTHRU, two menu-based BRS offerings, were not available through the iNet gateway, so the original command-language system was used.

THE TELECONFERENCE AND DATACONFERENCE

Considerable frustration in using BRS was reported by the participants, who had been encouraged to report any search problems to CMA through iNet messaging. Initially, the trial planning group attempted to set up a traditional BRS training session, but the travel time and time away from practice required for the physicians made this impossible. Instead, a combined teleconference and dataconference mode was chosen and the event was set up for a two-hour period on a Wednesday afternoon.

The dataconferencing facility of the iNet gateway allows one or more iNet 2000 users to view the session of another iNet subscriber. It was intended for use as a shared electronic workspace and as a tool for the iNet Customer Assistance Centre. The dataconference can include up to 13 sites, with one of the sites acting as the the host or chairperson of the conference. The particpants in the conference have the chairperson's session displayed on their terminal screen.

To arrange the dataconference, the participants were messaged by CMA with the date, time, agenda, and the objectives of the session. Copies of an abbreviated BRS Training Manual were also mailed out in advance. At the time of the dataconference, the sites were first linked by an audioteleconference through the Darome Connection in Toronto. As participants signed onto the teleconference, they were asked to log on to iNet and enter the MONITOR command followed by the ID of the instructor. When the participant entered the MONITOR command, the system informed the instructor that a request had been made to monitor her session and approval was requested. As soon as the approval was given by the instructor, her screen was displayed to the participant.

During this process, two unexpected events occurred that deserve mention so that others who use this facility can avoid such problems. First, as the requests to monitor appeared on the instructor's screen, the existing interaction scrolled off. This resulted in some confusion when the appropriate command to resume the regular session was needed. Fortunately, the iNet Customer Assistance Centre was contacted and provided instructions. Another difficulty was created by participants who had their printers on to record the session. The sound of dot matrix printers in the background did not enhance to quality of the teleconferencing connection, so a request was quickly made for participants to shut down their printers. A terminal and printers were set up in a separate room at CMA to record the session and the results were later transcribed and sent out to the participants.

Once the initial unexpected problems were sorted out, the combined teleconference and dataconference proceeded very smoothly. An introduction to the session was provided by the coordinator of the CMA Council on Medical Education, then the training session was begun by the librarian/instructor. Examples of search requests related to clinical problems had been sent in by the participants in advance of the session, and these were used to demonstrate the capabilities of the BRS system. A very streamlined version of the basic requirements for searching MEDLINE and displaying useful references was presented via the dataconference. After the training session, a general discussion of the trial and the problems experienced by the participants was conducted by the Research Officer of the CMA Council on Medical Education.

In order for discussion and interaction to occur in this mode, we found that it was necessary to observe a strict electronic "etiquette". The chair of the session must be well- organized and maintain explicit control of the interaction. During the discussion, the chairperson specified a geographic order in which the participants could make their comments. As each person spoke, they began by stating their name and location (or were reminded to do so). If a question was addressed to a participant in the conference other than the chairperson, the interaction was directed through the chairperson. After everyone had an opportunity to speak, final comments were made by the instructor and each site signed off. The iNet dataconference log off preceded the teleconference sign off. The instructor had simply entered the MONITOR OFF command which returned each participant to their own iNet session. Individual participants can also log off a dataconference at any time by entering their own command.

SUMMARY AND CONCLUSION

In general, we were very pleased with this alternative method for training physicians in the use of online systems. It solved the major geographic and time barriers to training that were encountered in this cross-Canada project. In the month following the training, connect time for the participants almost doubled from 14 to 26 hours and this usage level was maintained for the remainder of the trial. Analysis of a follow-up survey has also shown that training and use of appropriate search techniques are related to more positive views of online searching by the early adopters of this innovation (Marshall, 1987).

We did find that the session had to be meticulously planned in advance for both content and timing, since time was more limited than in the traditional classroom situation. In fact, the content and method of presentation had to be totally reassessed for presentation in this format. We had to do in two hours, the essentials of what traditional online search workshops do in a full day.

Pauses in the proceedings while assistance was given to individual sites was very noticeable and it was easy for the other sites to lose interest at such times. It is important to "keep things going" and to make any pauses as brief as possible. Care must be taken to give the participants an adequate opportunity to ask questions, since the regular visual cues to the need for clarification or further explanation are not present in the type of distance communication.

The cost of the training session included long distance charges to the Darome Connection in Toronto for each site; $20/hour for the use of the teleconferencing bridge; $15/hour per site for the use of the iNet gateway; and BRS online search charges for the instructor. Compared to cost of running a centralized training session, this electronic alternative proved to be much more economical.

To briefly summarize the requirements for this type of session, you require a system that has a dataconferencing facility; a teleconferencing connection; two telephone lines per site; and a lot of careful advance planning. In our case, the dataconference portion of the session did not have to be arranged in advance, since this facility was available as a regular feature of the iNet gateway. The teleconference session was booked in advance with Darome, who also taped the session. This tape was helpful for evaluation purposes. One of the major findings of the CMA iNet trial was that physicians who decide to use online systems directly will require ongoing training and support to search the databases effectively. This combined dataconference and teleconference presented a promising possibility as an innovative training tool for the future.

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A Value-Added Model of Computer-Aided Communication (CAC)

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ABSTRACT

In order to demonstrate that CAC adds value, the preliminary results of a planned longitudinal study are reported from three different groups making administrative use of the CoSy Conferencing System (from the University of Guelph). These groups were selected deans of Canadian faculties of management, institutional researchers and planners in Canada, and the executive council and committees of the Canadian Society for the Study of Higher Education. All CoSy usage was funded by the Canadian Higher Education Research Network. These groups were queried both as to the value they expected to find in electronic mail and in electronic conferencing. Though all data is not yet collected, initial indications are that those returning the survey expect both mail and conferencing to add value to their work.

INTRODUCTION

Based on the perceptions and actual usage patterns in these three groups, a value-added model of computer-aided communication can be formulated to further extend one for electronic mail (Licker, Newsted, Sheehan, 1987) in which perceived value is suggested as a better measure of electronic mail success than either use or preference -- though all three of these dependent variables are clearly related in a cyclical fashion. As suggested by these authors, evaluation of CAC must move beyond the tool stage where success is assumed to follow just from correct usage, and beyond the technique stage (where success is assumed to follow from an alteration of how individuals work and spend their time), to a determination of whether this usage and alteration actually matter and add value -- in terms of greater efficiency, greater social integration, greater awareness of opportuni-ties, improved problem solving, better threat avoidance, etc. (Boyd, 1986). Kiesler (1986) notes that the addition of such value can be expected to impact the whole fabric of an organization -- specifically an organization's problem sensing capacity can be expected to increase as people make their concerns known much more easily without the bother or time of a typed memo or scheduled meeting.

The following hypotheses can be derived from this model:

1. As value may not be obvious without experience, realized value should exceed initial anticipated value. As a corollary of this, it would not be expected that realized value would be significantly greater than expected if the expected value were already high.

2. It is hypothesized that the greater realized value will be seen for those individuals with greater use of both mail and conferenc-ing in CoSy.

3. Those groups which have a greater need to communicate (such as the executive of a society) will find CoSy much more valuable and use it more than other groups which typically do not have a need to communicate that is not met by annual meetings, newsletters, and other traditional forms

of communication.

4. Given the greater potential for group communication that is present in conferencing, it is predicted that this medium rather than electronic mail will not only be shown to have the greatest realized value, but also the greatest increase from perceived to realized value.

5. It can also be anticipated that there will be numerous interactions based on the character of the various groups. For example, the executive of the society might be expected to feel that greater value has been added for conferencing (because of their need for group communication), whereas the other groups might attach a relatively lesser value to this and might in fact value mail more for individual contact.

To test these hypotheses, this experiment will answer the following questions:

1. Are there changes in the expected and realized value of mail and conferencing when users are queried at the beginning of their use and again 4 to 8 months into their period of use?

2. Are there differences in expected and realized value based on group membership?

3. Are there differences in expected and realized value for mail vs. conferencing?

METHOD

The three groups available for study in this experiment were selected deans of Canadian faculties of management (DEANS), institutional researchers and planners (IRP) in Canada, and the executive council and committees of the Canadian Society for the Study of Higher Educa-tion (CSSHE). All CoSy usage was funded by Canadian Higher Education Research Network (CHERN, cf. Sheehan and Newsted, 1986). With the exception of the CSSHE group, not all members of a group were in-cluded. Selected deans were those chosen by the Executive of the Canadian Federation of Deans of Management and Administrative Studies as having the greatest need and interest in communicating electronically. Slightly more than half of all such Canadian deans were thus included. Participation in the IRP group was solicited both at conferences and by personal contact with institutional researchers and planners at major Canadian Universities. Table 1 indicates the number of members in each group.

Table 1. Individuals Surveyed.

Group	Size	Expectation Questionnaries Returned	Percent Returned
CSSHE	15	8	53
DEANS	35	13	37
IRP	19	9	47

The registration of users from these groups started in June, 1986, and is ongoing. The members of each group were not added simultaneously; typically those with both greater interest and more executive responsibility were brought online first. When an individual was added, he or she was sent a starter kit by the Network Information Centre (NIC) of CHERN. This consisted of a personalized word-processed cover letter welcoming the individual to CAC and explaining the nature of the other users of the group which also had CoSy access. This letter also explained the value of CAC --

specifically stressing the usefulness of conferencing over electronic mail. A full manual on CoSy, a short quick guide showing how to sign on and use mail and conferences, a data sheet with relevant Datapac numbers, and a questionnaire were included as well. Both this questionnaire and the intended follow-up one are given in the Appendix. Though not pretested per se, the questions used were derived from questions found to measure significant variables relating to the value of CAC as determined in the authors' previously cited work.

As is noted in the questionnaires themselves, they were not anonymous though the individual results have remained confidential to the NIC staff. This was done so that individual's initial expectations could be compared with their later opinions about CAC. So as to maximize the return of the questionnaires, those who had not responded (no matter when they had initially received their first questionnaire) were uniformly sent a reminder in mid-December, 1986. A new CoSy manual (1986 edition) as well as CHERN's most recent CoSy quick guide were included. The manual and guide were also sent to those who had returned the questionnaire thanking them for their response.

As is inevitable and desirable in any CAC setting, CHERN's NIC staff interacted with the members of these three groups to facilitate their use of CAC on CoSy and solve any access or usage problems they might be having. In addition to handling these problems through mail and conferencing on CoSy itself, a 24 hour "hotline" was also available for users to call. Staff were on site in the NIC at least 4 hours per day 5 days a week to handle calls directly. Calls not handled directly were returned by the next working day. Problems were typically solved within two working days after being raised.

The NIC staff also set up initial conferences for each of the three groups. Of the three groups, CSSHE also set up four more conferences on its own. NIC staff were members of all conferences but typically became involved only in a problem solving or explanatory role -- though several messages of encouragement were entered in conferences that seemed to be inactive.

NIC help was also available for those who wished to upload or download documents to or from microcomputers. This help was provided by phone, CAC contact, and through guides prepared by NIC on using Kermit on an Apple Macintosh or an IBM PC or close compatible. NIC supplied Kermit diskettes to those who requested them.

INITIAL RESULTS

At this point only the data from the first questionnaire is available. (Both this data and that from the final questionnaire will be presented at the conference). In order to confirm the likely situation that there would be no initial differences in expectations among these groups who were basically naive to CAC, the responses of each group on all 11 questions on the first questionnaire were compared using an analysis of variance.[1] Though sampling variation in groups as small as this is always a concern, no F's reached the the 5% level of significance for any of the questions. Given this similarity, data from the three groups was combined for the following analysis to determine if expectations differed with respect to electronic mail and electronic conferencing. Table 2 summarizes these results.

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[1] Though nonparametric statistics could have been used, it was felt that it was not unreasonable to assume that the seven-point Likert agree--disagree scales used here are in fact interval scales and hence amenable to parametric analysis (Kim and Mueller, 1978). The use of more powerful parametric tests is also appropriate in this rather new area of study where one is interested primarily in detecting correlations and trends while accepting the risk of including some spurious findings. Once refutable theories emerge, a more rigorous approach will be called for.

Table 2. Expectation Differences.

(Between electronic mail and conferencing, 30 pairs)

Question	Mail Mean	Conferencing Mean	t value (for related measures)
Easy to use	2.6	3.0	2.74 **
Help do a better job	3.0	2.9	.61
Be a frequent user	3.4	3.0	1.64
Prefer over typed letter	3.2	4.6	3.97 **
Expect to be satisfied	2.5	2.8	1.88
Position	5.3		

** t, $p < 0.01$

This table shows that there was more agreement that mail was expected to be both easier to use and to be preferred over a typed message than was expected for conferencing (t, $p < 0.05$). This does not seem unusual in that *a priori* electronic mail seems closer to its paper analogue than does electronic conferencing to its analogue of a multi-person meeting or a bulletin board. As neither conferencing nor mail were likely well understood by these initial nonusers -- even given the similarity to paper or inperson communications, the lack of significant difference in expected satisfaction and doing a better job is not surprising -- though expected satisfaction with mail nearly exceeded that expected for conferencing (t, $p < 0.10$).

In order to determine the initial existence of relationships between expected value, expected preference, and expected use -- and thereby giving further weight to the proposed value-added model of CAC, product-moment coefficients were computed between these and other surveyed variables. These values are given in Table 3.

Table 3. Correlations Between Expectations.

(Value (doing a better job), frequent use, preference
(over a typed message), ease, satisfaction, and present position)

Mail coefficients / Conferencing coefficients

	Satisfaction	Ease	Preference	Use	Position
Value	.68 / .53	.30 / .40	.50 / .23	.69 / .52	-.11 /-.31
Position	-.18 /-.04	-.18 /-.02	-.32 / .09	-.23 / .02	
Use	.68 / .58	.41 / .61	.40 / .41		
Preference	.61 / .45	.33 / .40			
Ease	.65 / .73				

Note: $r > +/- 0.36, p < 0.05, df = 28$
$r > +/- 0.46, p < 0.01, df = 28$

While the multitude of significant coefficients in this table clearly does not disconfirm a value-added model, it is likely that these significances may simply be due to a halo effect whereby respondents with uncertain knowledge about mail and conferencing are simply expressing similar opinions to all attitude questions. A much fuller evaluation of the model will be possible when data from the second questionnaire is available, and expectations can be compared with realizations.

Of note in this table is the generally lower correlations between position and attitudes toward mail and conferencing. Though there is a trend toward positive expectations about mail with higher position, these relatively low coefficients are likely due to the small variability in responses to the position question (mean = 5.3, S.D. = 1.0).

DISCUSSION

With these initial results, a fairly straight-forward picture emerges as to expectations about CAC. Users have favorable expectations, but neither the value of mail nor conferencing is apparent yet -- though they "agree" that it is expected.

Among Rogers (1983) criteria for an innovation's acceptance are observability and trialability which are likely relevant here as individuals are unsure of the value of a new technique until they have seen it and/or been able to work with it (let alone compare it to other comparable techniques). That individuals will find mail and conferencing to be of value is suggested by the fact that on the ease and preference dimensions, electronic mail -- which they likely can at least conceive of -- is found to be significantly easier and preferred (to a typed message) than is conferencing. Thus once users find out about conferencing, one would expect confirmation of the initial hypothesis that it too will be preferred add value and allow users to do a better job in their work place.

One would also expect that the importance (i.e correlation) of ease and satisfaction with use, preference and value would diminish as users become more familiar with both techniques. In other words, once electronic mail and electronic conferencing have been mastered and adopted into a daily work routine, ease and satisfaction which were necessary to cause their initial adoption will no longer be relevant or sufficient for continued adoption unless value is seen to be added to support ongoing preference and further use.

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APPENDIX

Initial Questionnaire

CHERN Questionnaire on CoSy Electronic Mail and Conferencing

For each statement below please circle the number that you feel most accurately describes your expectations of Cosy as provided by CHERN:

REGARDING ELECTRONIC MAIL:

1. CoSy electronic mail will be easy to use.

   Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

2. CoSy electronic mail will help me to do a better job in my work.

   Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

3. I will be a frequent user of electronic mail in CoSy.

   Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

4. I expect to prefer a CoSy message to a typed letter or memo.

   Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

5. All in all I expect to be satisfied with electronic mail in CoSy.

   Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

REGARDING ELECTRONIC CONFERENCING:

6. CoSy conferences will be easy to use.

   Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

7. CoSy conferences will help me to do a better job in my work.

   Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

8. I will be a frequent "attendee" of electronic conferences in CoSy.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

9. I expect to prefer a CoSy electronic conference to a face-to-face meeting or conference.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

10. All in all I expect to be satisfied with electronic conferencing in CoSy.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

For the following statement please circle a number that you feel most accurately describes the level of your current position:

11. Clerk 1 2 3 4 5 6 7 Chief Executive Officer

Though, this form has been coded with an identification number to aid in correlating your initial expectations with your later experiences (as well as allowing reminding of only those who have not returned forms), your responses will not be cited or attributed to you in any way. Your detailed responses will remain confidential to the CHERN Network Information Centre staff; only summary data will be made public. Once all data has been collected, and before it is examined, all links between code numbers and identifying information will be destroyed.

Form No. A _______

Intended Follow-up Questionnaire

CHERN Follow-up Questionnaire
on
CoSy Electronic Mail and Conferencing

For each statement below please circle the number that you feel most accurately describes your experiences with Cosy as provided by CHERN:

REGARDING ELECTRONIC MAIL:

1. CoSy electronic mail is easy to use.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

2. CoSy electronic mail helps me to do a better job in my work.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

3. I am a frequent user of electronic mail in CoSy.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

4. I prefer a CoSy message to a typed letter or memo.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

5. All in all I am satisfied with electronic mail in CoSy.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

REGARDING ELECTRONIC CONFERENCING:

6. CoSy conferences are easy to use.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

7. CoSy conferences help me to do a better job in my work.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

8. I am a frequent "attendee" of electronic conferences in CoSy.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

9. I prefer a CoSy electronic conference to a face-to-face meeting or conference.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

10. All in all I am satisfied with electronic conferencing in CoSy.

Strongly Agree 1 2 3 4 5 6 7 Strongly Disagree

For the following statement please circle a number that you feel most accurately describes the level of your current position:

11. Clerk 1 2 3 4 5 6 7 Chief Executive Officer

12. What is your age in years? _______

13. On average how many electronic mail messages do you send each month? _______

14. On average how many electronic mail messages do you receive each month? _______

15. How many electronic conferences do you regularly attend? _______

16. Approximately how many transactions do you add in total each month to all the conferences you attend? ______

17. On a monthly basis, how much would you be willing to pay for your use of CoSy? $_______

18. Is your primary use of CoSy done by yourself or by an assistant or secretary?
______ Self ______ Assistant/Secretary

Though, this form has been coded with an identification number to aid in correlating your initial expectations with your later experiences (as well as allowing reminding of only those who have not returned forms), your responses will not be cited or attributed to you in any way. Your detailed responses will remain confidential to the CHERN Network Information Centre staff; only summary data will be made public. Once all data has been collected, and before it is examined, all links between code numbers and identifying information will be destroyed.

Form No. B _______

Computer Conferencing - A Tool For Hospitality Professionals

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ABSTRACT

To simulate current and future professional practice, a computer conferencing system was used as one application in a seminar course on Computer Applications in the Hospitality Industry in the School of Hotel and Food Administration. The system was usedby 20 students in the fall of 1985 and expanded to 60 students in the winter of 1987. The application was evaluated as useful and effective by both groups although the larger and more recent group experienced some frustration from inoperable terminals and a system that was often overloaded with users.

In order to simulate current and future professional practice, a computer conferencing system was used as one application in a senior course of Computer Applications in the Hospitality Industry in the School of Hotel and Food Administration in the fall of 1985. These data are based on a first use of computer conferencing in an undergraduate course by the instructor and by the students in the School.

Following one tutorial session, 20 students joined aclosed computer conference which discussed their hospitality experience of the previous summer and was moderated by the instructor. CoSyis the trademark term used to describe the computer conferencing system software developed by the University of Guelph. The conference was active for five weeks during which time 247 messages were exchanged. Using the CoSy User's Guide, Version 3.1, (January, 1985) and getting assistance from the instructor when necessary, the students felt sufficiently supported to develop expertise at their own speed and on their own time. The ideas and thoughts discussed ranged from the profound to the frivolous. Many students commented that this electronic medium allowed a sharing of ideas not possible for them on a face-to- face basis.

Each student spent an average of 12.2 hours using CoSy and rated the overall usefulness and effectiveness of the application an average of 3.8 on a 5 point scale. Some typical excerpts from the closing remarks of the participating students included:

- "Not being a technical person myself, this has been a real break in a long list of frustration."
- "It certainly allowed me to overcome my terrible sense of computer anxiety."
- "I feel more confident than ever to approach a computer terminal, and curious enough to pursue its capabilities."
- "It was a fun, enjoyable, educational, interesting and useful computer application to learn. This is the first time I have ever felt comfortable with computers and even have a desire to buy my own one day."

There were no negative comments regarding the usefulness or effectiveness of the conferencing system.

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In the winter semester of 1987, computer conferencing was expanded in this course with the use of tCoSy to enable 60 students to form three closed conferences of 20 students each. tCoSy is the trademark term used to describe a computer conferenc- ing system developed especially for student participation at the University of Guelph in which the CoSy software is used. Students decided on their own salient conference topics and conferences were active for four weeks. At this time students used the CoSy Computer Conferencing System Reference Manual (November, 1986) and again developed expertise at their own speed and on their own time. While students again were generally positive about the experience, a sample of the students, 10 out of 60, rated the usefulness and effectiveness of the application at 2.9 in a 5 point scale. The students further suggested that while it was relatively easy to get a terminal to use, frustration level became high due to hardware that was inoperable or the system so overloaded that much time was consumed in queuing.

Computer conferencing was useful in providing a relavant tool for potential professionals in hospitality management. The first use of CoSy was instrumental in encouraging the instructor, other instructors and the students in the School of Hotel and Food Administration to participate in CoSy conferencing both in and out of the classroom. Subsequent and expanded use of CoSy through tCoSy, was also useful to students in hospitaltiy management although it pointed to some problems in hard- ware maintenance and system capacity. Expanded use in this course over this time period reflects expanded use of CoSy and tCoSy throughout the campus.

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Explicating Expert Opinion Through A Computer Conferencing Delphi

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ABSTRACT

This paper presents the results of a study of the development and implementation of a group decision making system consisting of a modified delphi technique and computer conferencing software. The principal line of inquiry relates to the comparsion of the intended and actual behaviour of experts who participated in the implementation of this system. The intended behaviour is reflected in the development of the system and derives from the research literature and experience dealing with group decision making and computer mediated communication. The actual behaviour derives from systematic observation of the exercise and the post exercise questioning of the participants. The content of the exercise was an inquiry into the forecasted impacts of technology on K-Adult education over the next five years, and a panel of national experts in technology and education was recruited for participation in the project. Analyses of the questions guiding the research provide the basis for implications for future practice and directions for further research.

Analyses of the post exercise questionnaire and of selected data taken from systematic observation of the exercise resulted in these major findings: 1) The perceived outcome quality is related to the perceived actual effectiveness of the system; 2) There was an inverse relationship between the level of self-ratings by the experts and the experts' satisfaction expressed that the issues were adequately explicated; 3) The clarity with which the process to be followed was communicated was related to the level of satisfaction with the actual effectiveness of the system; 4) The use of pseudonyms as a technique to mask the identities of the participants made little difference with regard to the uninhibited expression of their opinion; 5) There does not appear to be a relationship between frequency of participation and these variables: perceived actual effectiveness of the system, or perceived representation of the individual's opinions in the findings of the exercise, or the perceived outcome quality of the exercise; 6) Both elite and non-elite groups found the potential for this system to be greater than was achieved in this particular case.

GENERAL EDUCATIONAL ISSUES

Computer - Mediated Cooperation In Education: Group Learning Networks

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ABSTRACT

This paper explores the use of computer-mediated cooperation in education by examining two group learning strategies (seminars and working groups) recently employed in on-line course activities offered by the Ontario Institute for Studies in Education. The paper describes the on-line course design and analyzes data on rates, patterns, and nature of user participation and interaction within the two group strategies.

Introduction: On-line Cooperation in Education

One of the most significant (and perhaps intriguing) benefits of computer communications for educational delivery may be its potential for facilitating group collaboration across time and distance. In recent years educational and training institutions in Canada, the U.S.S., and Europe have begun to implement formal group learning activities within computer conferencing environments. Educators in distance education programs are attracted to computer conferencing in the anticipation that on- line group learning activities can contribute to reducing student attrition and to improving learning effectiveness (Deutschman et al, 1985; Haile, 1986; Kaye, 1987). Emerging research indicates that the nature and quality of group interaction facilitated by computer-mediated communication may also offer certain advantages over classroom education (Hiltz, 1986; Harasim, 1987).

The principal characteristic of computer conferencing and perhaps its most important feature for educational applications is the nature of *interaction* which is encouraged by the medium. Much more than a technical device for exchanging information, conferencing can facilitate the sharing of knowledge and understanding among group members. Users are able to participate in various types of group interactions on-line, including cooperative learning activities. It is this latter type of interaction that is the focus of this paper.

Cooperative or group learning, in the traditional face-to-face classroom, refers to a set of instructional methods in which students are encouraged or required to work together on academic tasks (Johnson & Johnson, 1975; Slavin, 1986). While the terms cooperative or group learning encompass a range of activities, they all utilize cooperative task structures based upon individual learner participation in achieving a common goal through peer interaction.

If active learning participation and group interaction are key factors in cooperative learning (Sharan & Sharan, 1976), then the computer conferencing environment suggests an appropriate context. By providing opportunities for active participation and group interaction and by allowing these interactions to be time and location independent, computer conferencing offers possibilities for learning collaborations and networking that have hitherto been impossible to facilitate or to contemplate. However, while this medium offers significant potential for education, it also holds new and unexpected challenges. Little is known about what actually happens when cooperative learning approaches are mounted on-line. If computer conferencing offers the potential for groups participation and interaction, it does not guarantee it. While some reported cases of on-line education achieved high rates of learner participation and group interaction (Hiltz, 1986; Harasim, 1987), other researchers found that achieving an active membership (in which members are actively *writing* as well as reading notes) has been a problem in on-line educational activities (Umpleby, 1986). Haile (1986), analyzing cc in one set of distance education courses, found that the activities were teacher-centred, with little evidence of student interaction.

Moreover, research on computer-mediated group communication indicates that even when participation and interaction are achieved, there are important differences from face-to-face collaboration. Literature on the effects of computer-mediated communications suggests that the medium changes the process of group collaboration (Hiltz, Johnson, Aronovitch, & Turoff, 1980; Hiltz & Turoff, 1981; Kiesler, Siegel & McGuire, 1984). Existing research indicates that there is less hierarchy and more equal participation in computer-mediated collaboration (Kiesler, et al, 1984). Siegel, Dubrovsky, Kiesler and McGuire (1986) hypothesize that since computer-mediated communication lacks mechanisms for displaying or enforcing social differentiation among people, that participation rates within the on-line medium should be more equal. On the other hand, on-line groups experienced more difficulty and required more time in reaching a consensus (Hiltz, Turoff, & Johnson, 1981; Siegel et al, 1986).

Despite increasing interest in computer-mediated group learning environments, not enough is known about how to design and implement such a setting; how to design computer-mediated cooperative learning; and how to facilitate on-line group learning activities. How will the asynchronous text-based medium affect learning participation and interaction? Are different group learning strategies (i.e. discussion groups and working groups [1]) affected differently by the on-line environment?

This paper will address part of this design challenge; it focuses upon the nature of group participation and interaction by examining rates and patterns of participation, distribution of communication, and consensus development within specific on-line courses. The courses discussed in the paper employed two different cooperative learning strategies: the discussion group and the working group. The implications of the on-line medium for these different group learning strategies are also explored.

The data for this paper were collected from field research. Both quantitative and qualitative data are presented. Quantitative data on the rates and patterns of participation were gathered through system-generated usage statistics. Data on user reactions were collected from students using qualitative methods such as participant observation and analysis of selected course conferences. As the interactions were entirely text-based, transcripts of the proceedings (of class discussions) were available on-line as printouts. Several on-line conferences which recorded user impressions and experiences of learning on- line were selected as key sources of data. Transcript analysis also permitted the quotation of user comments. Participant experiences are provided here to show what it was like from the learner's point of view to participate in on-line group learning activities.

Background

The Ontario Institute for Studies in Education (OISE) is the Graduate School of Education of the University of Toronto. Since 1985 OISE has used the Participate[2] computer conferencing system to experimentally deliver both credit and non-credit courses and to support group learning networks among geographically dispersed participants. Participate offers facilities for electronic mail, asynchronous conferencing, real time (synchronous) messaging, electronic polling, editing (both line and full-screen) as well as search mechanisms whereby the users can locate conference items and topics. many of its features have proved valuable for designing an on-line educational environment. For example, the software has topic joining action which establishes a user record to keep track of what notes a user has seen in any topic joined; topic branching facilities that from groups as subsets of larger groups; access controls; and knowledgebase editing which includes tools for moving subtopics so that they are better indexed, for modifying topic openers to summarize notes that follow, and tools for keyword searches (Stevens, 1986). Advances in computer communications software are opening new possibilities of electronic group learning and research environments.

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[1] While the emphasis on peer interaction (cooperative task structure) is the distingushing feature of cooperative or group learning, the strategies vary in the degree to which they use cooperative reward structures (rewards to groups based on group members' performance)(Slavin, 1986). The discussion group, for example, is based upon peer interaction but does not typically involve a group reward; a working group, however, in the educational setting is usually premised both upon group work and group reward (i.e.,a grade given to each group's product)

2 Copyright (c) 1986 Network Technologies International, Inc., Ann Arbor, Michigan, U.S.A.

Two OISE courses delivered entirely on-line are described in this paper. The courses were the same: Women and Computers in Education [3] but were delivered in different sessions, each over a 12 week period (Course 1 in the winter session, Jan-April, 1986; Course 2, Sept-Dec, 1986). While both courses were OISE graduate-level courses, in Course 1 an additional group of teachers participated as part of a non-credit professional development activity. Course 1 had 17 graduate students and 21 professional development students; Course 2 had 12 students. The majority of the students were female; in each course there were three males. In both courses there was a range of computer expertise, ranging from computer novices to those who considered themselves experts. Two instructors participated in both courses, although in each case one served as the principal course instructor.

Students were located in cities, towns, and villages throughout the province of Ontario (Canada). They were linked with one another and the instructors through their microcomputer, modem, and a telephone line which enabled them to access the Participate conferencing systems housed on one of OISE's Vax 11/750 minicomputers. Students participated in asynchronous conferences, sent and received electronic mail, used synchronous messaging and text editing, and participated in electronic polling.

Course Learning Design

The design of the on-line courses was based upon a cooperative learning approach. A varied learning 'environment' was created through the use of conferences and conference branches to provide separate 'spaces' for specific activities. The learning design included both 'core' learning activities (three discrete phases) and on-going supplementary or informal activities (a conference for informal discussions and socializing; a group 'Learning Log'; a mutual 'Assist' conference for technical questions and answers; a 'Library' space for communication with the librarians; etc.) The electronic mail facility was used for personal communication.

All course discussions were carried on-line by computer conferencing. Some other aspects of course-related activities, however, were handled in traditional mode. For example, two face-to-face meetings were held: an initial half-day session providing hands-on training in the basics of computer conferencing; and a full-day session, held approximately mid-way through the course, to facilitate the formation of working groups. Print materials were also important. Each student received a printed learning kit with course guide, readings, and technical documentation on computer conferencing at the outset of the course.

The 'core' learning activities were designed as three phases, each approximately four weeks:

1. Phase 1: On-line group discussions or seminars mounted as a series of four one-week sessions. Peer information-sharing and analyses were based upon prior reading (off-line) assigned for that topic. Both whole group and small group discussions were employed.

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[3] Readers should please note that the courses examined in this paper are different from those described by Dr. L. Davie in his paper for this Symposium.

2. Phase 2: on-line working groups to undertake research activities and develop an on-line class presentation. Groups ranged in size from 4 to 9 members each. A group reward structure distinguished this phase: interdependence among the members of each group was structured by the mutual goal (the class presentation) and mutual concern for achieving it (a group grade).

3. Phase 3: class feedback to each 'presentation' and assessment of the course topic and process based upon group discussion.

Results of the Analysis: Rates and Patterns of User Participation

Data for the analysis of the rates and patterns of participation were generated by the Participate system itself: it provided usage statistics on time on-line (hours/person) and the amount written (calculated as Participate pages/person [4]). For each conference message the system recorded the name of the sender and the number of characters per message.

Rates of Participation and Interaction:

Participation occurred within a general context of 58 different conferences and subconferences in Course 1, and 35 in Course 2. Personal messaging (e-mail) was also employed on an informal basis.

Preliminary data analysis indicates a high level of user participation and group interaction in the learning groups:

1. In Course 1, graduate students averaged 4.22 hours/person/week while the non-credit professional development students participated 3.5; in Course 2, graduate students averaged 3.6 hours/person/week. These rates were significantly higher than the course requirements of 2-3 hours/week.

2. Analysis of the number of conference messages sent indicates active participation. In Course 1, the graduate students sent an average of about 90 conference messages per person, while the professional students averaged about 60 conference messages per person. In Course 2, graduate students sent an average of about 120 conference messages each.

3. The interaction reflected high levels of learner-learner exchange. In the typical face-to-face classroom, the teacher does most of the talking. Depending upon the environment, up to 60-80 percent of the verbal exchanges come from the teacher (Dunkin and Biddle, 1974; McDonald and Elias, 1976). Generating peer interaction in the classroom is not easily accomplished. This was not the case in the on-line courses examined here. Analysis of selected seminar conferences (Phase 1) indicated that the principal instructor wrote 10% of the total number of (text) exchanges, while in Course 2, the figure was 12%. In related to the volume of messages (the number of characters entered), similar analysis showed that the principal instructor wrote 12.5% of the message volume in Course 1 and 10% in Course 2.

4. Interaction among the students was dynamic. Analyses of selected seminar conferences (Phase 1) in both courses indicated significant peer interaction. Approximately 65- 70% of the conference notes made specific reference to previous notes (agreeing, debating, questioning, synthesizing, extrapolating, expanding.)

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[4] The storage utility can be used to generate a report of per user data base storage, tallying the number of Participate pages written per user. Each note takes at least one Participate page. Notes take one Participate page for the first 367 characters and an additional page for each 494 characters thereafter. Only text records are counted.

Patterns of Participation and Interaction:

Analysis of participation rates in relation to the three learning phases and in some cases, in relation to the user group, yielded insight about the on-line group learning strategies. Examination of message traffic, amount written, time on-line, and rate of input indicates some patterns of participation in relation to the three phases and the three student groups.

Message Traffic:

Analysis of the message traffic (the average number of personal and conference notes [5]) in Course 1 & 2 sent indicates the overall importance of personal messaging for group activities. Personal networking (writing private messages) was very active throughout all 3 phases in both Courses.

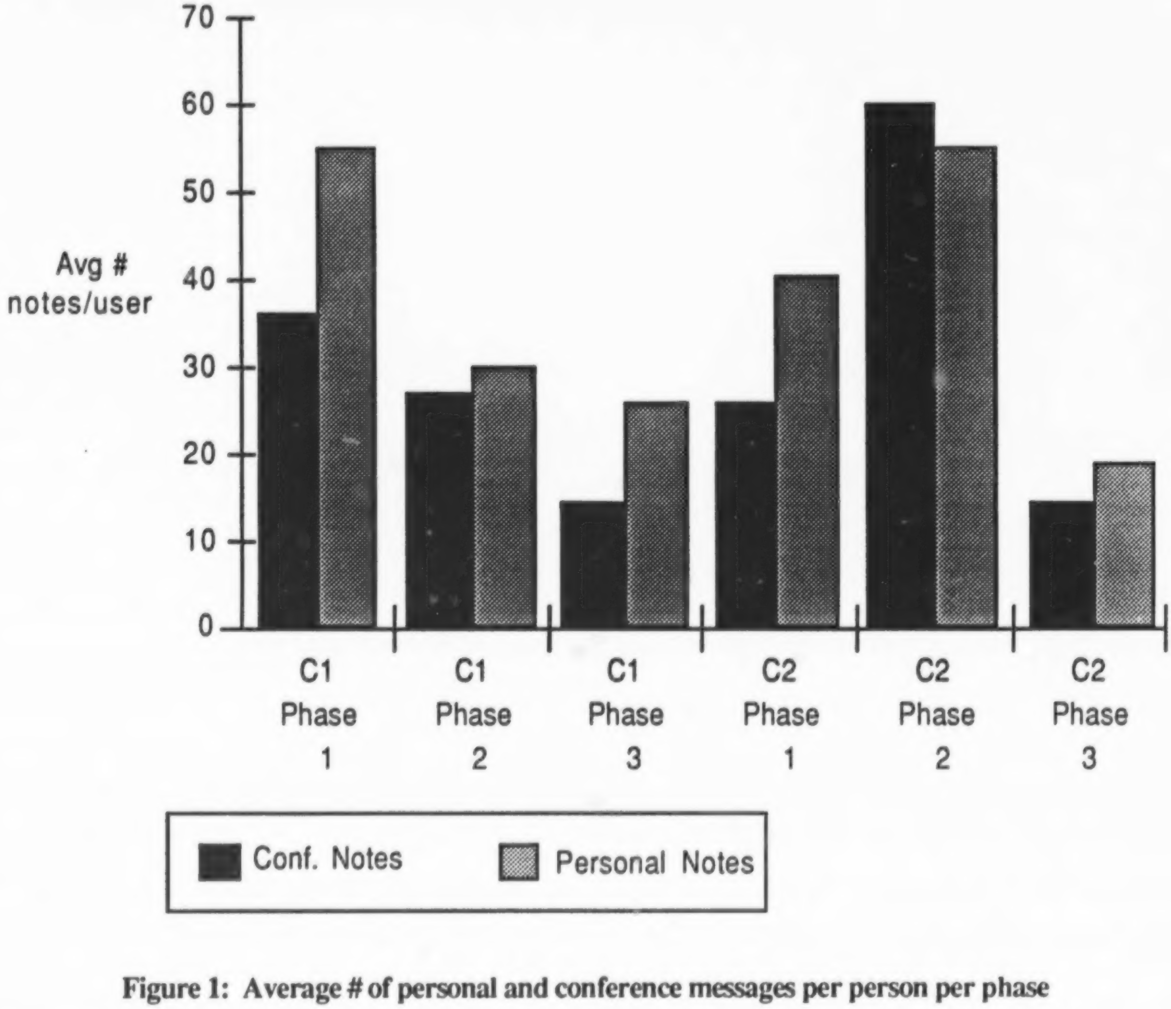

Figure 1: Average # of personal and conference messages per person per phase

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[5] The figures for the number of conference notes is exact; the number of personal messages, however, is based on close estimates.

The rate of personal messaging appears to indicate a significant level of connectivity or social cohesion which helped to create a sense of community and possibly made the system more fun to use.

Some variation in message traffic, however, can be seen between the 3 phases. In Phases 1 & 3 personal message traffic was almost 50% higher than that of conferencing messages. In Phase 2 (the working groups), on the other hand, the number of conference notes sent roughly equals the number of personal messages: communication during the working group phase appears to have occurred almost equally through both conference and personal notes. This phenomenon may be related to the task oriented nature of the activity and/or to the smaller size of the group. Participants reported feeling time pressures during this phase and that their communication tended to be task related and hence group directed. Another related explanation is that friendships are more likely to be shared by all or most members of a small group where there is more opportunity for constructive cooperation than in a large group (Sharon, 1980 p.24).

The on-line courses had essentially two types of conferences: the 'core' (formal learning) conferences in three phases and the ongoing informal conferences (for socializing, informal networking, technical assistance, etc.). Figure 1 data on the number of conferencing messages included both 'core' conferences and the informal conferences. Further analysis of data indicates that in Course 1, for example, 58% of the conference messages in Phase 1 occurred in the informal conferences; 16% in Phase 2; and 22% in Phase 3. In Course 2, 38% of the conferencing in Phase 1 occurred in the informal conferences; 26% in Phase 2; and 29% in Phase 3. In both courses, informal conference messaging decreased in Phase 2 (the working groups.)

Figure 2 shows the average number of conference notes in the 'core' learning activities during the three phases in Course 1 and Course 2. Both courses had a similar pattern: the number of course conference messages sent peaks in Phase 2, the working groups.

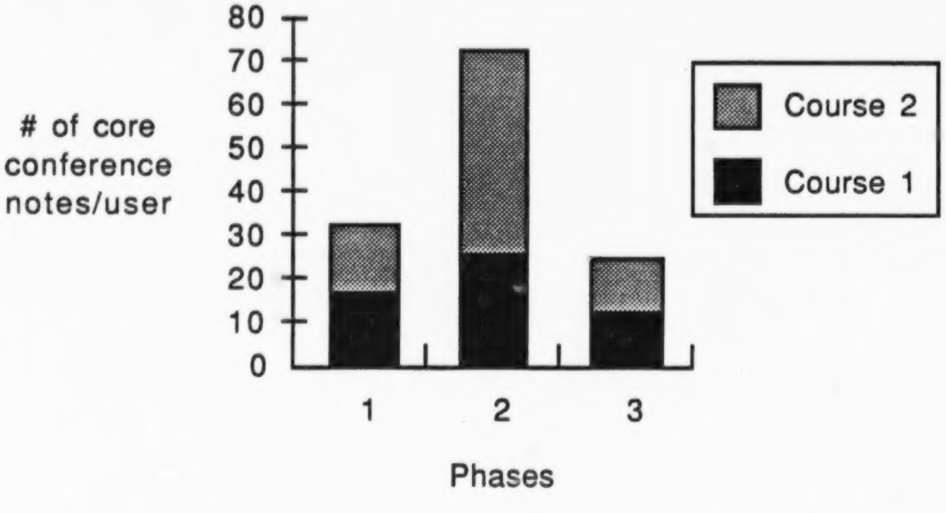

Figure 2: Average # of core conference messages per person per phase.

Amount Written

Given that there is no 'average' user, however, the use of boxplots can show distribution in student usage. Boxplots are employed in the following subsections to display data on the amount written, the amount of time on-line, and the rate of input. The box shows where the middle 50 percent of the usage means are,, with an '+' at the median level; the lines go to the left and the right to what may be regarded as the 'norma' extent of the distribution beyond the central part (the 'I' indicating the 25%

and the 75% quartile), and the *'s and 0's mark extreme values. The phase and the student group [6] are also identified.

The data in Figure 3, the amount written, show different patterns among the user groups in the various phases. In Phase 1, the seminar phase of the activities, the median for on-line contributions (measured as the number of Parti pages) is similar for all three groups: 50% of the users in all groups wrote approximately the same amount in this phase. However, the pattern then changes. In Phase 2 (the working group) both sets of graduate students increase the amount of text that they input on-line, while the amount written by the pd students decreases after Phase 1.

The pattern of input is the same for the grad students in both courses: the amount of on-line contributions peaks in Phase 2. This pattern differs from that of the professional development students whose input decreases after Phase 1.

The patterns of participation for the grad students are different from the pd students: whereas the amount of input by the grads peaks in Phase 2, the amount of input for the pds dips after Phase 1.

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[6] Group A = Course 1 pd students; Group B = Course 1 grad students; Group C = Course 2 grad students

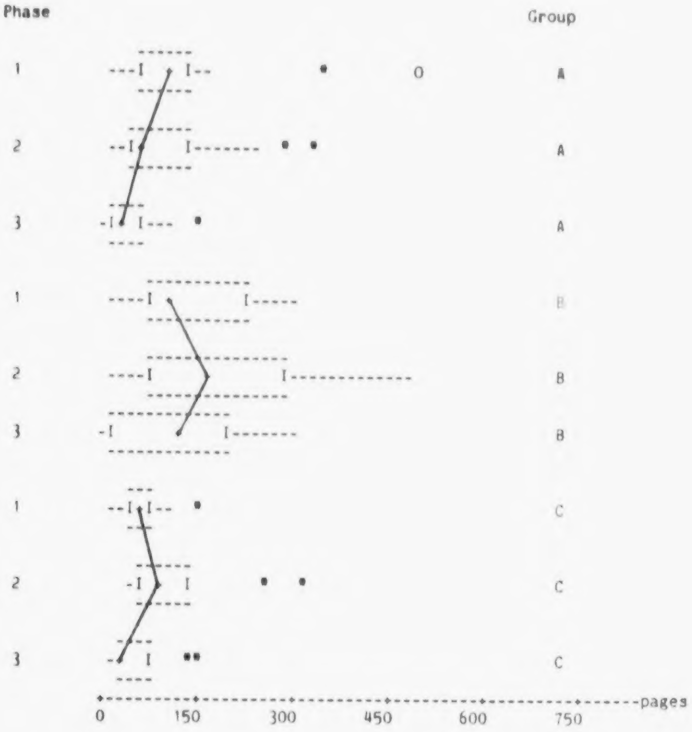

Figure 3: Amount written per phase group

The data also reflect high end usage by Course 1 grads: this group shows more usage as well as more variability. The top half of this group have more input than both other groups. Course 1 grad students exceed the other groups in the amount of output in all three phases.

The other two groups reflect relatively low variability in relation to the amount written: most students contributed relatively equal amounts.

Time On-line

The use of boxplots was valuable for displaying distribution of time on-line as well. Figure 4 shows the number of hours on-line per phase per student group. Certain patterns of participation may be identified. One is the similarity in the rate of time on-line in Phase 1 by all three groups of participants. 50% of the users in all three groups participated an average of about 18 hours per person. The medians and the lower quartile are almost identical for all groups in this phase. Phase 1 is the seminar or group discussion phase, a period emphasizing group interaction.

In Phases 2 & 3, however, different patterns emerge in relation to the user groups. For the grad students in both courses, time on-line is high for Phases 1 & 2 with a decrease in the final feedback and wrap-up Phase 3. The median (50% of the users) for the grads was also similar in the first two phases. This pattern differs from that of the pd students, whose time on-line decreases after Phase 1.

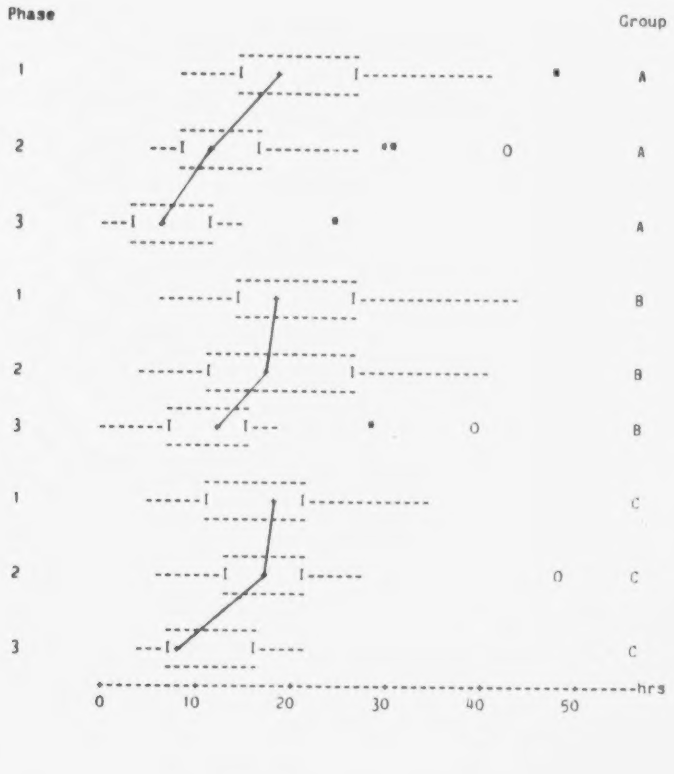

Figure 4: Hours on-line per phase

Rate of Input:

The rate of input is measured by the amount written per on-line hour. The boxplot distribution in Figure 5 shows the distribution in the rate of input by group over the three phases.

The data in Fig. 5 shows a similar pattern by all three groups: an increase in the rate of input after Phase 1. In Phases 2 & 3 the half-way point has moved up to where the top quarter was in Phase 1: representing a shift of about 25%. The data reflect a consistent increase in the rate of output in Phases 2 & 3: participants are writing more per hour in Phases 2 & 3.

Additionally, the data suggest a fairly low variability overall. The rate of input by most participants in each student group is not highly divergent. There are a few extremes, but generally most students are participating and within each group the rate of contribution is relatively equal.

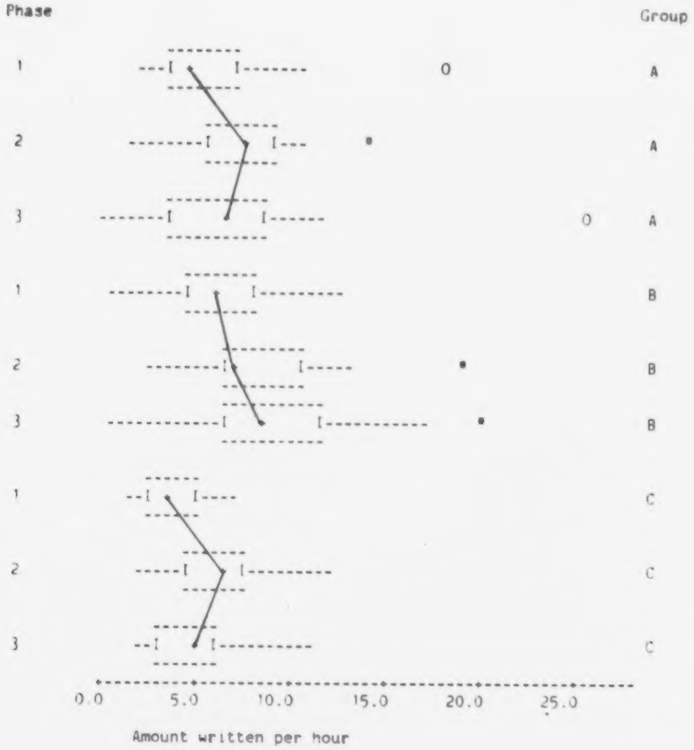

Figure 5: Rate of input per phase per group.

Some Thoughts on Measuring and Interpreting Usage Patterns:

To explore fully the variables which influence usage patterns in on-line activities is beyond the scope of this paper and the present stage of data analysis. However, while the use of exploratory techniques such as boxplots indicated certain patterns of participation, the analysis has also generated questions. We can only speculate on some of the causes for the patterns identified in the preceeding section and raise the questions: this should be of value to future research.

The first questions reflects on the measures for on-line participation. As the on-line educational environment is essentially text-based, participation in this context was measured by time on-line the system, amount of text input on- line, and the rate of input (per on-line hour). However, the validity of such measures as 'time on-line' is increasingly questionable as students are becoming increasingly skilled at downloading conference proceedings and working off-line. In Course 2 approximately one-half of the students reported doing much or most of their reading and some writing off-line. In one- half of the students reported doing much or most of their reading and some writing off-line. In cases where students pay for their own long distance or Datapac charges, the motivation to download and work off-line may be even greater. Rate of input may be a more useful measure, since it takes into account not only the time on-line but the amount of test entered. By considering the rate of input, decreasing time on-line can be seen as not necessarily indicating diminished interest or participation, but perhaps increased efficiency in communicating on-line. Evolution of learning strategies such as more selective reading and writing and use of up/downloading text may contribute to the intensity of on-line interaction and to more efficient and focussed learning interaction during the on-line period.

Factors such as the nature of the learning task may also affect participation statistics. For example, the increased rate of input by all three groups after Phase 1 may relate to the type of learning activity in each phase. Possibly a seminar or group discussion involves a different type of on-line interaction from the working group which affects the rate of input. More on-line time may have been spent reading comments, reflecting, possibly composing responses, rather than actually inputting messages in Phase 1. The increased time on-line in Phase 2 (the working groups) might suggest that the group task orientation required more active messaging and perhaps more text overall (for the on- line presentation).

The nature of the reward structure for the different learning tasks may also influence participation. Data on amount of input (Fig. 3) and time on-line (Fig. 4) reflected differences between the pd and the grad students: whereas the participation of the grad students increased in Phase 2 (the working groups), that of the pd students decreased. Might this be related to the fact that the grad students received credit for their participation and their group product, while pd students did not have this same external motivation?

Fourthly, how does the nature of the group affect participation? Attributes such as level of skill in computer conferencing, and/or in computers or even keyboarding, may influence the rate of input. Increases in the rate of input after Phase 1 may be related to increased comfort and/or skill in writing on-line.

Finally, 'rate of input' is a measure of efficiency and may have limited value alone for reflecting the educational value or effectiveness of particular activities. The use of participation statistics as indicators of group or personal performance, while they may be valid to a certain extent, is of limited usefulness. One reason is that usage statistics can be manipulated by the user. Perhaps even more important is the fact that the nature of the interaction cannot be measured by quantity of output alone. Other, qualitative analytical units need also to be taken into consideration in analyzing on-line educational interactions.

The identification of such qualitative units is beyond the scope of this paper, but the next section explores two aspects of the nature and quality of on-line group learning: the distribution of communication and decision-making within the learning groups.

Results of the Analysis: Nature of Group Participation

While the preceding section explored rates and patterns of communication within computer-mediated group learning activities, user reactions provided valuable information on the nature of on- line group participation. This section provides qualitative information on the distribution of communication and consensus decision-making within the on-line learning groups.

Distribution of Communication:

Participation of group members (in social psychology) refers to the distribution of communication within the group. Siegel et al (1986) notes that social psychology research has found that rates of participation in many (face-to-face) groups are unequal: participation is largely influenced by such factors as external social status cures, physical cues such as race and gender, and personal competency. She hypothesizes that since computer - mediated communication lacks mechanisms for displaying or enforcing social differentiation among people, participation rates within the on-line medium should be more equal. Computer - mediated communication is a text-based medium and fails to communicate (or at least to impose) differentiating social cues such as high external status or personally dominating style.

This section introduces some key themes raised by students in their on-line discussions about the distribution of communication in the learning groups [7]. The data (boxplots) in the previous section suggested that in terms of the amount and the rates of input, variability among students within each group was relatively low: most students participated and, within each group, rates of contributing were relatively equally distributed. User reactions support this finding.

Students in the on-line courses reported that (in their opinion) the on-line medium promoted more equal participation than do face-to-face classes. As one student noted: "*I think that there is a lot more communication here than I find in my on-site courses. As I also said, I feel a greater sense of cooperation within this group*." And students reported that this factor contributed to increased participation. Comments such as the following were common: "*As far as communicating in the course goes, I can definitely say that I contribute at least 50% more frequently in this course than in regular courses* ." Noted another student: " *I have been much more of an active participant in this course than in any other OISE course. As other students mentioned, actual hours spent on the course have certainly been greater* ." Students reported that the increased participation in the on-line courses contributed as well to learning effectiveness. "*I learned much more than in a regular three hour course because of the interaction of all the students in the course. It is much more enriching this way. Through this medium we could tap the combined knowledge of the group* ."

Students identified various characteristics of on-line communication which they felt had been important to facilitating more equal distribution of communication (and which encouraged more active participation):

1. The text-based medium contributed to an emphasis on what was being presented rather than on the presenter, hence diminishing the stereotyping associated with physical appearance. *"One of the interesting aspects of learning this way is that you learn about a person, discuss with a person, share ideas with a person and have no preconceived ideas about the size, shape, age, or look of the person. How many times do we make a first impression based upon looks? Too often, I'm afraid. Conferencing breaks down many social barriers based on appearance."*

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[7] For further discussion of these themes, see Harasim, 1987.

2. Some found it easier to related to the content, rather than be influenced by the presenter: *"I find it much easier to separate the person from the message: I can easily agree with (student X) on some of his notes, and then quickly disagree on his next one."*

3. The medium was viewed as more democratic in terms of access: *"Conferencing as a course vehicle promotes more equal interaction among participants, dropping barriers of geography, urban/rural styles, social skills, mannerism. "* Participation was not limited by where one lived or work nor when one was available to study. As students noted, it was a '24 hour classroom': always open.

4. Group interaction was facilitated. Given the asynchronous medium and the convenience of access, students could log on at any time and engage in peer learning: *"To me, the major success of this course has been the truly interactive involvement through this medium. There was always a large support group (including peers and instructors) to respond to technical, academic, and even emotional (morale boosting) needs. I've never been involved in a course in which I've learned so much from other students. This was the result that there was no competition for the floor and therefore everyone was able to have her (generic use of pronoun) say. Also, as remarks were all documented, they were subject to more in-depth discussion."*

5. Other students agreed that the lack of competition for air- space (unlike the classroom or audio conferencing modes) contributed to increasing the group interaction and individual participation in the learning activities. The asynchronous nature of the medium allowed each learner to participate to the degree that she or he wished. As a student observed: *"The nature of conferencing allows an individual to finish her thoughts without fear of interruption by some keen, more outgoing colleague. I feel that this is a great equalizing force in a group."* This lack of competition for 'air time' was important for many who might otherwise not be active participants in group situations, i.e., students who feel self-conscious or who are not aggressive in a face-to-face group, or perhaps who are not fluent in the language or instruction.

6. The asynchronous nature of the medium also discouraged individual domination, including that of the instructor. This promoted more active participation and greater peer interaction in learning. Students commented that *"there is a protocol observed to varying degrees in the classroom which directs all communication through the teacher...The result has been that I do not know the other students in the class very well...(On the other hand) although teachers can guide in this (on-line) medium, they simply cannot take a central role."*

Also identified were factors which negatively affected participation and group interaction:

1. The lack of physical cues (such as facial expressions, voice intonation, gestures) was a source of some frustration, particularly initially (as users were becoming accustomed to on-line communication and were also building a group dynamic). Early notes commented on the 'impersonality' of text-based communication. Even as these concerns faded with time, a number of students noted that the text-based medium was problematic for expressing (and catching) nuances, jokes, etc. Given the limited cues, there was more room for misinterpretation. Students began to employ typographic conventions to overcome the difficulties of expressing nuances in ascii characters: spelling out facial expressions **grin**, using asterisks to indicate emphasis, s p a c i n g the characters out, or marking out <irony>.

2. Following the multiple discourse threads of group discussions was problematic in the text-based medium. In group discussions, a variety of themes or threads might emerge. Students reported 2 specific difficulties: following several, parallel discussions; and deciding how to interact (respond immediately or read all the comments before responding).

3. Some students wondered whether the text-based medium may not discriminate against users with poor writing skills.

4. The other important problem identified with the asynchronous medium was related to the time problems (delayed feedback). *"It is like speaking into a vacuum."* Other aspects of the time issue are explored further in the next section which examined group decision-making in the learning activities.

The above features indicate important issues to be considered in future designs of on-line learning groups. Overall, students felt that the on-line medium promoted more egalitarian and more active group interaction. However, it is important to emphasize that democratic participation within the cc medium is not a given. With the increasing sophistication of the cc systems, and the evolution towards more complex communication environments come features which also provide more access controls. The 'democracy' of the medium is an issue of educational design rather than of inherent system features.

Consensus Development:

An important aspect of group interaction is decision-making and consensus development. Consensus development, that is the process of resolving conflict in order to arrive at a decision, is affected by computer-mediated communication. Researchers have found that groups using computer-mediated communication to make decisions experience more difficulty and take longer to reach a consensus than do face-to-face groups (Siegel, et al, 1986; Hilz, et al, 1980; Rice, 1984).

In the examples presented here, problems in consensus development occurred in the working groups but not in the seminars or group discussions. Seminars and group discussions are primarily based upon peer interaction and information-exchange; achieving a consensus or common product or perspective is not typically anticipated as the conclusion.

However, group decision-making and consensus are central to working group activities. And students reported that decision- making was problematic in the group work.

On-line working groups have a common goal: to generate a group product (a class presentation). The process of conducting the group project is one of continual decision-making as group members must identify a project focus, develop a plan, assign individual tasks, coordinate the activities, set and meet deadlines, and agree upon a finished product. The difficulties of undertaking these tasks on-line were exacerbated by the asynchronous medium: lengthy waits occurred between the time an issue was raised and all the group members would log on and respond. Consensus decision-making on-line was found to be slow and often frustrating.

The major problems encountered were: too little structure; insufficient coordination of group tasks; individual members not completing their tasks at the assigned time; irregular participation; not working cooperatively but rather competitively; and lack of interpersonal feedback among members of a group. In the case where groups were not able to establish a coordination and organizational structure, the group process and the product was weak. The members of these groups felt dissatisfied with the experience, while in the more successful groups there was a positive feeling of having successfully achieved a group product.

This field research indicates emerging guidelines for successful on-line working groups. Among the most important strategy which the working groups developed was the early identification of a group focus and structure. The latter involved establishing the tasks for each group member and a timeline for meeting the tasks. Groups in which some mechanism for task coordination had been established seemed to function better. Regular and frequent contact among members of the group, and providing group feedback and encouragement were also critical. Another tactic which groups found very important was to arrange to meet on-line and to message synchronously and (asynchronously). Telephone calls and in some cases a face-to-face meeting were also employed if possible (although the latter was exceptional).

One group member shared some suggestions: *"What helped a lot was the chance to meet face-to-face at the start of the project to clarify roles and tasks. We later realized how important this step was...(Moreover) communication can be done fairly easily if you are all on-line at an agreed time. What really facilitates on-line group work is having group members on-line frequently, i.e., every two days, to speed up the communication process. Another important characteristic is that group members know when to be flexible in their views: they make their statement and leave room for others to give theirs. Finally, that people settle tasks early in the project and attend to deadlines---this really reduces frustrations."*

The size of the group was another factor which affected don-line decision-making. As one student noted: *"A collaborative writing assignment undertaken by a group of more than two people is difficult even when conventional methods are used..."* Student comments indicated that the greater the group size, the more likely were problems of coordination and decision-making. *"With a group of four you get a nice mix of skills: some people are great at researching, interviewing, writing, or editing. Our group worked very well together but found the slowness of communication frustrating at times...Working in pairs is much easier: there are fewer opinions to synthesize. "* Larger groups seemed to pose a problem, particularly under circumstances with limited timelines. *"After working on-line with a group of four, I wonder about a larger group being able to work efficiently. Coordinating four people on-line is hard work---more could really be tough."* However, while smaller learning groups might be more manageable in a limited time frame, other students noted that too small a group may not have sufficient diversity of perspective to open up the exploration of issues. Also, peer group pressure may not be strong enough to control a dominant participant. Rudduck (1978) noted that in face-to-face groups (both adolescent and higher education), problems arise in a small group if there is no diversity of experience and style to bring vigour and surprise to the enquiry. "It seems that it is easier for students to talk in a very small group--but more difficult for them to find the content which will support depth of learning" (ibid., p.56). Optimal group size for the face-to-face mode is still a matter of discussion. Rudduck finds that 6 to 10 is optimal for face-to- face groups, while Sharan & Sharan (1976, p. 31) suggest a figure of 5 to 8 participants. The implications for on-line learning groups are not yet known.

Task structure and leadership may also be important factors. Although our sample was small, the larger-sized working groups that were successful reported that establishing a clear structure which outlined the individual tasks, timelines, etc., and some form of coordination (whether by 1-2 individuals or the collective) significantly facilitated decision-making and the group process online.

It should be noted that in some aspects, the on-line medium also apparently facilitated resolution of problems. The following comment describes an experience in the working groups: *"While we were working in groups, my colleague and I had a disagreement. It was caused by fatigue over the presentation and on my part a lapse of on-line protocol of remembering to provide explicit positive feedback when it is deserved. In sorting this out we became aware that such a resolution would not have occurred in the classroom but probably would have sat there simmering until further problems were caused. As it was we were both able to express ourselves and clear up the misunderstanding. It has occurred to me since that we clarify misunderstood responses only with very close friends or with people with whom we have a very crucial relationship. Rather than dim my enthusiasm this situation has demonstrated to me the face that human face-to-face communication can be carried on over this medium with perhaps a few more safety nets because of the distance and the text medium."* Other students agreed, adding that on-line communication seemed 'more objective' and also provided more opportunities to contact the other person and discuss the issue in greater depth.

Another issue to explore is the role of the cooperative task structure and the reward structure in developing a sense of group on-line, and hence facilitating decision-making and conflict resolution. A common problem noted by network observers over the years is uninhibited on-line behaviour referred to as 'flaming'. Kiesler et al (1984, p.1129), for example, found that people in computer-mediated groups were more uninhibited than they were in face-to-face groups, at least as measured by uninhibited verbal behaviour, defined as frequency of remarks containing swearing, insults, name calling, and hostile comments. Our experience in the on-line courses was very different: students reported increased sense of group responsibility and community. Kiesler (ibid) notes that in computer-linked groups that are on friendly, cooperative terms, the medium might encourage and facilitate joint projects.

Conclusions

The most important conclusion to be drawn from the experiences presented and analyzed here is that computer conferencing is a medium within which group learning can take place. Computer-mediated communications can---with sound educational design--- provide a highly active and interactive and effective group learning environment.

Computer-mediated communication offers the potential for unprecedented access andinteractions---we now have the possibilities for and emerging examples of global educational networks (for learning, research, peer exchange, etc.). Beyond serving as an electronic analogue to or substitute for classroom activities, the new medium opens new options for effective and dynamic group learning that in such aspects as diversity of input and increased interaction may in fact be better than face-to-face activities. However, while case examples such as those analyzed in this paper indicate high rates of participation, interaction and distribution of communication in on-line learning groups, we need a greater understanding of the conditions under which such general tendencies occur and can be facilitated. Little is as yet understood about the interaction between such factors as the nature of the learning task or activity, the task structure, the reward structure, and individual or group attributes within an educational context.

Future research on these issues is needed to bring to light key issues fore the educational design and implementation of on-line group learning.

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Computer Conferencing For Delivering Educational Services

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ABSTRACT

Although computer networks for educators have proliferated, most consist of simple electronic mail. In New Jersey, opportunities for more sophisticated educational applications are being pursued on the Electronic Information Exchange System (EIES), a computerized conferencing system located at the New Jersey Institute of Technology. With a modem and appropriate communications software, applications can be extended far beyond those available through electronic bulletin boards and commercial utilities.

INTRODUCTION

Conventional modes of information exchange - telephone, mail, meetings, journals, newsletters, etc. - no longer meet educators' growing needs for timely communications and information exchange. This is critical for pre-college teachers, whose structured workday creates a sense of isolation from their peers. Few opportunities exist for them to meet on a regular basis to share instructional ideas and resources. Although many teachers have developed new methods and materials to improve classroom instruction, implementation is limited to the small number of students they teach. There are no resources at their schools for disseminating the results and evaluating their utility in other settings. The absence of an effective communications network causes the wheel to be invented many times over; the lack of systematic evaluation keeps concerned teachers from finding the best wheel available.

Computerized communication is an innovative approach for improving instruction. It can support educators with a wide variety of information services, which include support for professional development and curriculum improvement efforts (Shea, 1984; Reynolds, 1984). Telecommunications not only bring the outside world into the classroom, but also can take the students and classroom into the world to discuss topics of interest with students in other locations, "visit" with scientists or other professionals, and participate in inter- school activities. It can provide the opportunity for students to meet and work with their peers and experts at distant locations.

Through this medium, teachers and their students become involved in new and stimulating experiences, that are not limited by the constraints of time and class scheduling. The ability to send text long distances instantly allows interaction to become global in scale.

THE ELECTRONIC INFORMATION EXCHANGE SYSTEM

EIES (the Electronic Information Exchange System at the New Jersey Institute of Technology) is a computerized conferencing system that includes electronic mail, conferences (in which a permanent and modifiable transcript of the proceedings is maintained), notebooks (designed for joint composition of documents), and tailored communication structures to meet the special needs of users.

EIES allows geographically dispersed participants to be linked through microcomputers and local telephone calls. Teachers participate at the site, time, and pace of their choosing. Time, cost and

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distance are minimized as barriers to interaction.

Educators communicate with their peers and experts and translate this information exchange into effective classroom teaching. Online dissemination is a process of linking teachers with resources and includes follow up. Mechanisms to support group processes, including decision aids, survey capabilities, voting, and databases tailored to the needs of the group allow the participants to develop and assess criteria for evaluation.

ELECTRONIC COMMUNICATIONS IN EDUCATIONAL SETTINGS

Networking

The most rapidly developing application of electronic communications in elementary and secondary education is the establishment of regional messaging or conferencing systems to connect teachers with each other and university faculty.

Two examples are MARYNET (Heidelback, 1984) and COMSEC (Kimmel et al., 1984). MARYNET provides a medium for an informal resource exchange for Maryland educators, students and parents interested in curriculum applications of microcomputers. COMSEC was designed to serve New Jersey educators, but has been extended to include out-of-state participants. Teachers using COMSEC can discuss issues of common concern and share teaching resources and ideas.

In some cases, regional or national electronic networks have been established for specific educational groups. Examples include a local geographic computer bulletin board network for physics teachers (Bowen and Kennedy, 1986), a state-wide computer conference for science supervisors, and a national network or chemical educators (moore, 1985).

Local physics teachers can dial into the system from their school computer with a request for information or help with a particular concept or topic, and teachers at other schools can respond. It also allows personal interactions, periodic in-person meetings and equipment sharing.

The electronic conference of the New Jersey Science Supervisors Association was established on EIES in response to the expressions of interest from members of this professional association. Monthly meetings of the NJSSA did not provide sufficient time to discuss the myriad issues of concern to science supervisors. Their computer conference permits the continuation of dialogue and a written records of their discussions to supplement their meetings.

CHYMNET is a national network of high school and university chemistry teachers linked through the CONFER system at the University of Michigan. Most are trained to conduct workshops on computers in chemistry for other chemistry teachers across the country. CHYMNET provides immediate feedback on workshops, and assists in the distribution of experiments or handouts used at the workshops. Participants also share ideas for improving their classroom teaching.

These networks provide similar benefits for their teacher participants. They offer computerized meeting places that allow the informal exchange of ideas and an opportunity for group resolution to problems of mutual interest. Each network offers an open exchange of ideas shaped by the participants and designed to address the isolation of teachers from resources outside of their work location.

Classroom Support

Beyond the simple electronic messaging system employed in these networks, opportunities for more comprehensive educational applications are being supported through computerized communications, including professional development, curriculum improvement and direct student hands-on involvement with this evolving technology.

Information utilities are becoming a growing application of electronic communications for both teachers and instructional media specialists (Teague, et. al., 1986). Commercially available electronic information sources and online databases are now used to complement classroom teaching. Non-commercial efforts have included the development of a mechanism to provide access to the materials of a university library for teachers and their students (Kimmel and Manock, 1984). Although limited in scope, these utilities and databases offer up-to-date supplementary materials to the information available in schools and public libraries.

Support of Professional Development and Curriculum Change

Computerized conferencing is now being demonstrated as a valuable support facility for professional development and curriculum development in New Jersey. The New Jersey Institute of Technology and Fairleigh Dickinson University are using EIES to improve middle school and junior high school science teaching in the northern half of the state. The goals include professional development, curriculum innovation, and improvement of classroom instruction. Six curriculum workshops are offered each year. At the workshops teachers explore and begin to evaluate new and modified curriculum materials. Between workshops they are linked on EIES for continuous support during the classroom implementation phase of the project. As teachers consider lab activities and demonstrations they experienced at workshops, they develop and share materials, worksheets, laboratory data sheets, and especially classroom management experiences through EIES. Classroom activities presented at workshops are evaluated and improved on the system. Student questions arising from workshop activities are referred to college faculty through EIES.

Traditional curriculum development has been a school-based effort. Where states do not dictate content, proficiencies and curriculum vary widely. The implementation of new curriculum is a local isolated event under these circumstances. This project has initiated inter-district cooperation and participation in curriculum, resource and activity development in a way that is not possible by traditional means. There are no geographical limitations to this process.

Formative evaluation of these teaching improvement efforts is facilitated by EIES. The system allows ongoing data collection about the level of activity of each participant and school. The need for occasional supportive school site visits is based on low online activity levels. Schools and teachers with exceptional activity are also identified, so that site visits are also made to identify conditions conducive to high-level participation.

This model is unique because it allows teachers to join at any time, regardless of location, and access resource materials, support from college-level educators, and a collection of teacher-validated activities for enhancing science curriculum and teaching. As a result, major obstacles can be overcome which have impeded the restructuring of science content and teaching. The model addresses the isolation of school teachers from resources outside their immediate teaching environment, as well as the major identified root of the failure to implement new curricula - the lack of continuing support and assistance for teachers during the implementation process.

An Online Curriculum Materials Retrieval System

The development of an electronic curriculum resource retrieval system is now being undertaken on EIES. Educators seeking classroom materials related to a topic they are teaching can retrieve these resources at their school computer for classroom use (O'Shea, Kimmel and Kerr, 1986). Database retrieval systems are not new. What has been absent is a database that can provide both information and curriculum materials for elementary and secondary school teachers in a way that is simple to use and sensitive to the highly structured nature of the school day. Only material that has been classroom tested and evaluated by teachers in terms of utility and appropriateness for a given grade level and subject is retained in the system. One long-term goal of this service is to replace the textbook as the core of the science curriculum.

Direct Student Involvement

The earliest reported efforts of direct student with telecommunications were "electronic field trips" and a "global project" (Edwards, 1984). The electronic field trips involved a telecommunications hookup with a scientist at a distant industrial site in which the scientist described a technical process taking place at the site and answered student questions. The global project had classes of students in Honolulu, New Zealand, and Pago-Pago conducting water temperature measurements and salinity tests as a group project. Planning and determination of the parameters to be measured were conducted on EIES. The students discovered that alkalinity levels of water samples taken at Pago-Pago Harbor were much higher than those at the other locations. This was traced to a major fish cannery that was dumping highly salted water into the harbor.

Part of the NJIT-FDU effort described earlier has involved inter- school student projects. For example, two eighth graders at a middle school in Northern Jersey and an eighth grader at a middle school in Central Jersey worked cooperatively on activities from a curriculum packet on Astronomy (provided by the American Association for the Advancement of Sciences). Using homemade astrolabes, shortwave radios and clocks, they determined the longitude and latitude of their respective schools.

Other teachers and students have recently become involved in acid deposition measurements. They are collecting rain and snow samples and reporting the pH values as pooled data. Results are compared for different school locations. All reported data and collected results are being stored in a conference on EIES. IN addition, the teachers and students are collecting and analyzing particulates in the air. Thus, an online experience is being provided in the classroom in which there is a sharing of scientific data by students in geographically dispersed locations. Electronic communications are used for planning, measurement reporting, decision-making, exchanging data, and pooling data collected.

CONCLUSION

Without questions, computerized networks for teachers significantly reduce their isolation from peers and provide opportunities for interaction to share resources and strategies, seek help from experienced colleagues, and work cooperatively to develop new curricula and instructional methods. In-service teacher education can be facilitated through computerized conferencing. Aspects of teaching that can be supported by computer conferencing include:

- Disseminating information about new curriculum materials;
- Interacting directly with curriculum developers;
- Collecting evaluation data from teachers who have tested materials in their classrooms;
- Planning training sessions with teachers that are tailored to their needs;
- Sustaining post-workshop enthusiasm through continued interactions among workshop participants;
- Connecting teachers to resource people throughout the academic year as teachers work to implement and adapt materials to their local curriculum;
- Formative evaluation of new materials, instructional strategies and implementation plans.

Computerized communications enhance these activities, save on time, travel and costs that would otherwise be incurred if these functions were to take place at face-to-face meetings. Traditional methods of group interaction and materials dissemination no longer suffice.

Post-secondary institutions have the technology and experience to facilitate group discussions and decisions via computerized conferencing. Pre-college teachers need to continuously update their subject matter expertise. Cooperation among participants (pre-college and post-secondary educators) must be encouraged and nurtured at all levels if higher education is to play a large role in the teaching reform movement of the 1980s.

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Integration of the Electronic Blackboard and the Electronic Overhead Projector

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INTRODUCTION

In September 1981, the University of Ottawa started using the latest in telephone technology to offer a credit live, simultaneously in two communities 120 kilometers apart. Two years later, in a pilot project using the same telephone technology, courses were taught live from a classroom in Ottawa to classrooms in Edmonton (Alberta), St.-Boniface (Manitoba), Moncton (New Brunswick), Church Point (Nova Scotia) and Dartmouth (Nova Scotia). A wide variety of credit courses are currently being offered daily to many communities in Ontario. The same network is being used to link various groups from around the world for live conferences and meetings.

The University of Ottawa, through the Service for Continuing Education, has a long tradition of making credit courses available off campus. This service meets the needs of people who have the ability and who want to increase their knowledge and develop their skills, but whose professional or personal commitments prevent them from coming to campus to take courses on a regular basis. This paper presents technologies which we used and/or developed at Ottawa University and their integration for providing service to the teacher.

1. COURSE DELIVERY

The goal of reaching out beyond the main campus to the community has been attained through the use of several different modes of delivery. The oldest, and most widely used mode, is the familiar correspondence course. These are primarily print-based courses, but may also include slides and audio tapes, which are delivered to the student's home. The student completes the assignments and returns them to the University for evaluation. In this mode students work on their own whenever they want, but they have very little contact with their professor or with fellow students.

Television is another mode that is used to deliver university courses to students in their homes. A television course is a combination of a correspondence course and a series of specially prepared television programs used to enhance and complete the printed material. Like the correspondence course, the television course leaves students working on their own with little contact with their professor or fellow students.

Over the years, the travelling professor has been the most successful mode of delivery for education at a distance. This mode differs completely from the first two, in that it brings the students and the professor together in a classroom of a community located away from the main interaction between students and between students and professor.

The newest mode of delivery is based on the use of telephone lines. This mode maintains most of the elements which made the travelling-professor mode so successful yet, at the same tim[illegible] overcomes most of the limitations associated with it.

2. TELEPHONE AND COURSE DELIVERY

Making use of the telephone to deliver courses to remote communities became possible with the transformation of the familiar telephone handset. Invented as a device enabling one individual to interact with another, the handset has become a loudspeaker and a set of microphones, making it possible for groups of individuals to interact with other groups of individuals.

When a course is given by telephone, it is taught to a group of students who have come together in a classroom in an off-campus community. The classroom is equipped with a loudspeaker and a set of microphones, one microphone for every three students. The originating classroom with its professor and a group of students, which may be on campus or in another off-campus community, is also equipped with a loudspeaker and a set of microphones. The professor wears a headset microphone with a five-metre cable that allows for freedom of movement. Just before class begins one centre calls the other, the loudspeakers and microphones are switched on and class begins. Like any telephone conversation, everything that is said in one room is heard by everyone in the other room and vice versa. Students in either centre interact with one another and with the professor simply by depressing a switch on the microphone.

There are, nevertheless, many courses that cannot be taught easily without a blackboard. To meet this needs, the University has added an electronic blackboard to the audio network. The electronic blackboard, which looks very much like an ordinary portable blackboard, has a pressure-sensitive surface. When the surface is touched, it emits a signal that is carried by regular telephone lines to all remote centres, where whatever has been written on the board appears on a regular television screen. Centres equipped with the electronic board as well as with the receiving device can exchange written information with the other centres. For large classes several monitors can be placed strategically throughout the classroom, or the receiving station can be connected to a giant projection monitor.

Given the physical absence of the professor, the electronic blackboard provides a focal point for students in the remote centres. Without a visual presentation students are completely dependent on a single sense of hearing to grasp the ideas. The board can be used effectively to present the various topics of discussion during a given lecture. This will assist students in their understanding of the logical organization of the lecture or discussion.

The audio system combined with the electronic blackboard creates a natural teaching environment. There are, nevertheless, some instances when the professor would like to be able to transmit live visuals other than blackboard writing. This might be the case for courses with a laboratory component, or for a course involving various forms of demonstrations. Slow-scan television is a device that makes it possible to transmit still pictures over regular telephone lines. Regular video cameras are used to freeze a single picture, which can them be sent out to all centres equipped with a receiving station. It can take anywhere from thirty to ninety seconds for the complete picture to appear on the screen at the remote location, depending on the resolution required, hence the designation "Slow-Scan".

The University of Ottawa undertook a pilot project with two centres equipped with slow-scan television. The originating classroom had two video cameras. A mobile camera was used for taking pictures of the slide projection screen, the class, the professor and the guest speakers. The second camera was in a fixed position and was used like an overhead projector to transmit a variety of still images, such as charts, graphs, pictures, etc.. A small control box with three switches sat on the professor's desk. One switch selected the camera, a second chose the picture and the third one began the transmission. The combination of audio, the electronic blackboard and slow-scan television creates a sophisticated telephone-based distance education network.

The selection of equipment for the classrooms is guided by the desire to disrupt the natural teaching/learning environment of the classroom as little as possible, while ensuring that the remote locations can participate as freely as possible. It means finding microphones for students and professors that are effective and unintimidating. The Service for Continuing Education worked closely with a consulting firm in Ottawa to design a special microphone for the students to meet these requirements. When students wish to make an intervention, they simply touch the button on the microphone, sit back and speak. The professors are provided with a light-weight headset microphone with a good length of cord that allows them to walk about freely, use the blackboard and continue to transmit a clear, uniform sound.

That the system be interactive in real time is the one principle that has dominated the development of the network. Students in the various centres are able to interact verbally with the professor or other students in any other centre at any time during the course. The electronic blackboard is also interactive in real time. Students in a centre that has a blackboard may interact with the professor or with students in any other centre. The professor, for example, can write the first part of a problem on the board and have it completed by a student in one of the remote centres.

Interactivity in real time gives the students the opportunity to participate actively in the teaching/ learning process. Questions can be raised and comments can be made at that point in the presentation which is most beneficial to the student. Because the network is interactive-in-real-time, professors are free to use the same various teaching styles and techniques as they do in the classroom. Straight lectures, question and answer periods, group discussions, student presentations, problem solving, etc. are all styles that are easy to handle on the network with several centres as they are in the classroom on campus. The interactive network lets students hear one another's questions and comments. this is an important asset in helping students evaluate their own learning and understanding of the material. Other student's questions and comments can draw classmates' attention to difficulties, weaknesses or important points in the material under investigation, which may have otherwise been overlooked.

3. THE ELECTRONIC OVERHEAD PROJECTOR

There are, for example, many professors for whom the overhead projector is the main teaching aid. At present, copies of the overheads are made and distributed to all the centres. During the lecture a student in each centre changes overheads at the request of the professor, and everything works very well. there are, however, two problems: the professor cannot draw the students attention to a particular aspect of the overhead by pointing; the professor cannot draw the students attention to a particular aspect of the overhead by pointing; the professor cannot unveil the overhead step by step. The Department of Computer Science at the University of Ottawa has developed the software for a computer-based animated overhead projector. The program is simple to use and lets a professor prepare overheads, with text and graphics that are actually more effective than traditional overhead, even in local mode.

The program can easily be used with the telephone network. Each remote centre is equipped with a computer and a modem. The disk containing the overhead is sent to each centre before the lecture, or it is down-loaded just before the class. The professor in the originating classroom controls the disks in all centres and moves through the overheads in a prepared order simply by touching the space bar on the computer, or with a hand- held remote-control unit. A computer-generated pointer lets the professor draw attention to any part of the overhead. When the computer based overhead projector is combined with the electronic blackboard on the same screen, the professor can combine free- hand drawing or writing with the computer-generated text and graphics.

The electronic view graph is the combination of a facsimile machine and an electronic blackboard. The facsimile machine is a small box that sits on the desk. It has an opening for feeding in pages much like a photocopying machine. When pictures, maps, charts, printed pages, etc., are inserted into the machine they are transmitted via the telephone line to remote sites where they appear on a monitor. The person transmitting the information may then point to any part of the screen and an arrow will appear on the remote monitors. It is also possible to write over the picture, complete the picture or text and erase the additions without modifying the original text. Hard copies of the material appearing on the screen may then be printed out in each of the sites provided a printer is available. Because the EVG is interactive students can use it to reply to questions or to return assignments and tests to the professor. The EVG will be extremely useful for those courses that make use of a lot of maps, pictures and charts because it allows the professor to point to any part of the screen. Not being able to point at the screen is the one disadvantage of copying the material and distributing it to the remote site prior to the lecture.

The electronic blackboard, the computer-based overhead projector, and the electronic view graph display text and graphics on a television screen. The standard twenty-five inch screen works well with groups of fifteen or less. When large numbers of students are involved, large screen projection systems or several of the smaller screens must be installed in the classrooms. Either configuration is expensive and cumbersome. There has recently appeared on the market a system that makes possible the use of digitized text or graphics cells with an overhead projector. Running the electronic blackboard and the computer through this system will be a simple, cost effective way to display text and graphics for large groups. Besides its simplicity, the overhead projector does not require as dark a room as the video projector.

At the present time separate telephone lines are required for the simultaneous transmission of voice and data. However, just appearing on the market are modems that will combine both signals on a single line simultaneously, without unduly affecting sound quality. Such a device, if proven successful, will reduce long distance costs by fifty percent. Line charges play a primary role in determining the number of students required in any particular centre to make offering the course cost effective. Where twenty students are now required with the present system, only ten will be required with the modem. The reduction will benefit minority groups, the more remote centres, and students in higher level or specialized courses.

CONCLUSION

The telephone-based distance-education network at the University of Ottawa is only one of many currently being used by universities, colleges and other institutions across Canada and around the world. They are not all identical, they do not all use the same equipment, but they all do use telephone lines to carry messages from one community to another. The system is flexible enough to accommodate various professor's needs through diverse technologies but integrated in one environment.

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Representing Educational Materials in Prolog

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ABSTRACT

Although Prolog has considerable power as a language for the representation and access of facts and rules, it suffers from a fundamental limitation: it does not allow the user to ask questions regarding the rules contained in the database. This paper presents a method that circumvents this problem by encoding rules as facts, thus making the rules accessible to the normal Prolog query mechanism.

This paper shows that the method permits concepts contained in a textbook to be encoded in a Prolog database. The concepts are accessed through a set of metarules. These allow one to ask questions regarding the meaning of a concept and relationships between concepts. We argue that this method builds the foundation for an expert system that has, as its knowledge base, the knowledge that is contained in a textbook. The paper also describes a means for creating new concepts interactively.

Introduction

In this paper, we present a method for using Prolog to represent and access a broad range of educational materials. We show how this method can be used to construct a data base that has, as its source, the knowledge that is contained in a textbook.

The possibility of recording educational material in a knowledge base is quite appealing. Given an attractive natural language interface, it would make educational materials available through a computer. Conceivably, it would permit the computer to replace the textbook.

We will restrict our attention to disciplines and textbooks that are non-interpretive. We have in mind subjects such as biology, chemistry, carpentry and motorcycle repair. We intentionally exclude areas that might be characterized as artistic, or interpretive. Literature is an example of an area that we would exclude from consideration.

We begin by giving a high-level characterization of the type of educational material that one finds in a textbook. We then examine the types of queries that one would expect to encounter when using a knowledge base that has a textbook as a source. These expectations are contrasted with the capabilities that Prolog offers. Finally we present a method for encoding educational material in Prolog.

Characterization of Educational Materials

Let us first say, perhaps as a matter of prejudice, that the primary purpose of a textbook is to provide the reader with a conceptual framework within which a subject is to be understood. This framework is based upon a set of interdependent definitions. Although the text may contain facts and examples, these are to be viewed as supportive of the basic conceptual framework of the discipline. We thus consider definitions and rules to be the essential material that is presented in a textbook.

We also note that textbooks do not normally present an exhaustive account of the facts that are related to a discipline. Indeed, textbooks most often give only a small sampling of facts. These facts may be considered as examples that illustrate the application of concepts.

Here we note that an expert system that is constructed on the basis of a textbook would be quite different from most expert sys- tems that are now in common use. This is largely due to the fact that most expert systems are based on decision trees, and are designed to solve a single problem or a group of closely related problems. In the case of textbook material, the appropriate organization for an expert system would be a network rather than a tree.

Questions Regarding Concepts

In the conventional use of Prolog, a definition or a concept is recorded as a rule. The rule consists of a set of conditions (subgoals) under which the definition is satisfied.

In this section, we examine a set of questions that pertain to the meaning of a concept. Essentially, these questions request information about the subgoals that underlay the concept. Thus if we were to ask about the meaning of "mammal", we would expect a response that describes the conditions under which an animal is a mammal.

In describing these questions, we assume an interactive query system that relates to the user through a natural language interface.

Here are the questions that seem natural and important to the understanding of a concept:

What is a <concept>?

> This query asks for the explanation of a definition. In terms of Prolog, this asks for the subgoals that must be satisfied in order for the definition goal to be satisfied. As an example, we may ask "What is a cancer cell?" The system would respond by displaying the appropriate properties, or subgoals, of a cancer cell.

Is <object> a <concept>?

> This query asks if a specific object satisfies the rules of a definition. For example, we may ask if a birch tree is de- ciduous. The system would respond either YES or NO.

What is the difference between <concept1> and <concept2>?

> In this case, the system must consult the definitions of the two concepts, comparing the subgoals of each, and displaying the those subgoals that permit the first concept to be differentiated from the second.

What do <concept1> and <concept2> have in common?

> This is similar to the previous question, except that the system compare the concepts with regard to similar subgoals. The response would be the set of common subgoals.

Is <concept1> a <concept2>

> This query asks if the subgoals of the first concept are contained in the subgoals of the second. In this case the answer would be either YES or NO.

This is not intended to be an exhaustive account of all possible questions. It does illustrate, however, that many of the obvious and important questions are in actuality questions about rules rather than questions about specific objects.

Limitations of Prolog

Prolog has a number of features that make it a very desireable

tool for the representing educational materials [1]. Amongst these features, we note that definitions and facts can be easily encoded in the language. It also provides a built-in query mechanism that allows the database to be accessed and interrogated. On the negative side, there are limitations and assumptions that are particularly troublesome when using Prolog to represent educational material. The most serious problems are the following:

1. Prolog allows queries about objects, but not about rules. We can ask questions such as "Is Charlie a professor?", but we cannot ask the question "What is a professor?" This is to say that the rule that determines whether or not Charlie is a professor cannot itself be the object of a query.

2. Prolog assumes that all available facts are recorded in the database. If a proposition is not recorded in the database, and is not derivable from rules in the database, then the proposition is assumed to be false. This is referred to as the "closed world" assumption. For example, if the database contained no information about Charlie, then the response to the query "Is Charlie a professor?" would be No. This will be Prolog's response even though Charlie is indeed the professor who has an office beside mine.

These problems must be overcome in order for Prolog to be a viable tool for the representation of the knowledge contained in a textbook.

Direct Translation to Prolog

It is natural to ask why an expert system cannot be constructed on the basis of a direct translation of a textbook to Prolog. One might argue that such a translation, if performed faithfully, would produce a knowledge base that replicates the information contained in the text.

There are three problems with this approach. First, such a database provides no mechanism for asking questions about the rules in the database. Second, the information in the database is unstructured and unorganized, giving the user no assistance in locating and relating topics and concepts. Third, the closed world assumption will produce erroneous results for queries that concern facts that are not included in the database.

These considerations lead to the requirements that are described in the next section.

Requirements of the Expert System

The following summarizes our requirements of an interactive system that makes available the knowledge contained in a textbook. The system should

1. Provide a mechanism for navigating through the knowledge base. This mechanism must allow the user to select topics of interest, and to ask questions relating to concepts that are explained in those topics.

2. Provide the ability to ask questions about concepts, and their interrelationships.

3. Provide the ability to construct new concepts on the basis of existing concepts.

4. Provide a means for eliminating the assumption of a closed world.

In the following sections we present a Prolog implementation that addresses these requirements.

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Navigation

A knowledge base should be able to describe its own contents. In the case of a textbook, the database should reflect the organization of the text. The following relationships allow the knowledge base to be organized and accessed in the same way that a textbook is organized.

- a set of topics
- a set of subtopics for each subtopic/topic
- a set of related topics for each subtopic/topic
- a set of concepts for each subtopic/topic
- a set of related concepts for each concept
- a set of examples related to each concept

Subtopics serve to give the database a hierarchical structure. Related concepts and related topics allow the information in the database to be organized as a network.

The effect of this type of organization is to allow th user to navigate through the database. For a given topic, he may request the concepts or definitions relating to that topic. Or he may ask for topics that are related to, or which are subtopics of, the current topic. A similar organization allows the exploration of concepts. This type of organization may be implemented in Prolog

through the assertion of facts of the forms:

```
topics (<topic1>,<topic2>,. . . ).
subtopics (<topic>,<topic1>,<topic2>,. . . ).
related_topics (<topic>,<topic1>,<topic2>,. . . ).
concepts (<topic>,<concept1>,<concept2>,. . . ).
related_concepts (<concept>,<concept1>,<concept2>,. . . ).
examples (<concept>,<object1>,<object2>,. . . ).
```

Metafacts and Metaobjects

When used in the traditional manner, Prolog does not have sufficient power to support the type of knowledge base that we require. This is due to the inability of Prolog to respond to questions about rules [2].

In this section, we present an approach that circumvents this problem. We do this by encoding rules as facts. Once this is done, we can, for the most part, use standard methods to query the data base.

A fact that represents a rule is called a metafact. Each metafact involves one or more metaobjects where each metaobject represents a concept or a definition. In the following description, we have used the "$" to distinguish metaobjects from ordinary objects. For example, $faculty might be used to represent the metaobject corresponding to the concept "faculty". (The reader should be aware that the use of "$" is syntactically incorrect in Prolog.)

A metafact has the following form:

```
rule (<metaobject>,<subgoal list>).
```

The subgoal list is the encoding of the subgoals that one would normally find in a rule. Each item in the subgoal list is itself a list containing the functor and the arguments of the subgoal:

```
[<functor>,<argument list>]
```

Normally the arguments in the argument list are metaobjects.

To illustrate method for encoding a rule, consider the following Prolog rules:

```
is_faculty (X) :-
    is_teacher(X),
    is_employee(X).

is_staff (X) :-
    is_clerical(X).
    is_employee(X).
```

In this case we choose $faculty and $staff to represent the concepts of faculty member and staff member, respectively. The metafacts corresponding to these rules are:

```
rule ( $faculty,
        [[is_faculty,$faculty],[is_employee,$faculty]]).

rule ( $staff,
        [[is_clerical,$staff],[is_employee,$staff]]).
```

A Rule for Instantiation

In the succeeding sections, we shall use a rule that instantiates an argument list. The purpose of the rule is produce a list in which occurrence of a metaobject in an argument list is replaced with either an object or a new metaobject. As an example,

```
instantiate ($a,[[x,y,$a],[u,v,$a]],$b,Z)?
```

will replace $a with $b in the list [[x,y,$a],[u,v,$a]], producing a list Z which has the value [[x,y,$b],[u,v,$b]].

Metarules

With the method for encoding rules that was outlined earlier, we will now describe the set of rules that can be used to access metafacts. We call these rules metarules. These rules allow the questions about concepts to be answered.

Consider the question

> What do <concept1> and <concept2> have in common?

This can be answered by the following metarule:

```
common ( X,Y ) :-
     rule(X,Xlist),
     rule(Y,Ylist),
     instantiate(X,Xlist,$common,Xlist2),
     instantiate(Y,Ylist,$common,Ylist2),
     intersect(Xlist2,Ylist2,Z),
     display(Z).
```

The first two steps instantiate the rules that are applicable to X and Y. This yields the lists Xlist and Ylist which represent the subgoals of the metaobjects X and Y.

The next two steps replace every X in Xlist and every Y in Ylist with a common metaobject, $common. This produces two new lists, Xlist2 and Ylist2. In the last two steps, these lists are intersected, and Z, the resultant list, is displayed.

We now consider a similar question

What is the difference between <concept1> and <concept2>?

for which we have the following metarule:

```
difference ( X,Y ) :-
     rule(X,Xlist),
     rule(Y,Ylist),
     instantiate(X,Xlist,Y,Xlist2),
     instantiate(Y,Ylist,X,Ylist2),
     subtract(Xlist,Ylist2,D1),
     subtract(Ylist,Xlist2,D2),
     union(D1,D2,Z),
     display(Z).
```

In this case, instantiate is used to cross-instantiate the lists Xlist and Ylist to produce the lists Xlist2 and Ylist2. Note that Xlist2 is expressed in terms of the metaobject Y, and that Ylist2 is in terms of the metaobject X. This allows the differences between the two pairs of sets to be produced in D1 and D2.

Finally, the question

Is <concept1> a <concept2>?

can be answered by the metarule

```
isa ( X,Y ) :-
     rule(X,Xlist),
     rule(Y,Ylist),
     instantiate(X,Xlist,$common,Xlist2),
     instantiate(Y,Ylist,$common,Ylist2),
     equal(Xlist2,Ylist2).
```

Avoiding the Closed World Assumption

As mentioned in a previous section, Prolog assumes a closed world. This means that if a goal cannot be shown to be true, then Prolog assumes that the goal is false. This presents a special problem in the following question:

Is <object> a <concept>?

If the database contains no information about this particular object, then it will respond NO. This is clearly not the appropriate response for the following questions:

Is a horse a mammal?
     or
Is Charlie a faculty member?

This problem can be solved by interactively intervening in the query process whenever a goal is not explicitly true or false. We begin with a variation of the isa rule used earlier.

```
isa ( X,Y ) :-
     nonvar(X),
     rule(Y,Ylist),
     instantiate(Y,Y,X,Ylist2),
     all_true(Ylist2).
```

This isa rule is dependent upon the rule all_true. This rule will succeed if all subgoals in Ylist2 are satisfied. The rules for all_true are the following:

```
all_true([]).

all_true(Y|Z) :-
     is_true(Y),
     all_true(Z).
```

The all_true rule will succeed if each subgoal in the subgoal succeeds with regard to is_true. We will not give the rule for is_true, but we will describe its operation. This rule will first check the database to see if the subgoal represented by Y can be satisfied. If not, then the user is interactively requested to supply information that is necessary to determine whether or not Y is true.

As an example of this process, consider the question

> Is Charlie a faculty member?

If we assume that the knowledge base contains no information about Charlie, then the interaction between the user and the system would be the following:

U: Is Charlie a faculty member?
S: Is Charlie a teacher?
U: Yes
S: Is Charlie a university employee?
U: Yes
S: Charlie is a faculty member.

Forming New Concepts

Since a concept is stored as a fact in the knowledge base, it can be readily manipulated and combined with other facts. A particularly interesting important to produce new concepts. Since

> Let <concept> be a superclass of <concept list>.

This concept is formed by intersecting the subgoals of the concepts in the concept list. The new concept is defined by the set of subgoals that are common to the concepts in the list. The following rule shows the creation of a new concept X, based upon the existing concepts Y1 and Y2.

```
superclass(X,Y1,Y2) :-
     rule(Y1,Ylist1),
     rule(Y2,Ylist2),
     instantiate(Y1,Ylist1,X,L1),
     instantiate(Y,Ylist2,X,L2),
     intersect(L1,L2,Z),
     assert(rule(X,Z)).
```

Once this concept has been stored in the knowledge base, it can be used as any other concept. That is, we can ask for a description of the concept, or can ask if an object satisfies the properties of the concept.

As a further example of the creation of concepts, consider

> Let <concept> be either <concept1> or <concept2>.

In this case, the new concept offers a convenient means for referring to either the first concept or the second. The rule for creating this concept is

```
either(X,Y1,Y2) :-
     rule(Y1,Ylist1),
     rule(Y2,Ylist2),
     instantiate(Y1,Ylist1,X,L1),
     instantiate(Y,Ylist2,X,L2),
     union(L1,L2,Z),
     assert(rule(X,Z)).
```

There are a large number of ways in which new concepts can be formed. The basis for a new concept can be union, intersection, negation, or any group of these used in combination.

Concluding Remarks

Expert systems have been very closely associated with decision trees. They have also been constructed with the purpose of solving specific problems. The system described in this paper is based upon a network structure of concepts, that are organized in a manner that allows them to be accessed as one would access a textbook.

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ELECTRONINC CONFERENCING
AND BEYOND

Conferencing Selection and Implementation: University of Arizona Case History

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ABSTRACT

The University reviewed various computer conferencing options during a two year period and began implementing CoSy in fall 1987. During the initial 4 months over 500 user accounts were established. The general approach involved educating critical personnel, adding users in groups where communications needs existed, penetrating key organizational units at alladministrative levels, and focusing on developing a "conferencing culture" on campus. Included are specific software selection criteria, examples of implementation policies and approach, and guidelines for new conferencing installations.

INTRODUCTION

When the University of Arizona decided to implement a conferencing system, the general campus knowledge of the subject was minimal, though a few (half dozen) people could be identified as experienced users of computer conferencing. The University, a comprehensive, research-oriented, public land grant institution with 31,000 students and 12,000 faculty and staff, includes 12 academic colleges and associated research centers, in addition to the Cooperative Extension Service, focused in 15 counties, and 4 rural-based College of Medicine units. It is one of three universities in Arizona, all under the same governing board.

Both before and during implementation, the literature and experiences of other installations (primarily CONFER, EIES, and BIX) were reviewed. Observation was also made of other systems by joining to discuss issues with their users. Time was spent in establishing a conferencing culture as well as examining technical use and specific applications of the system.

We will review the evaluation process and implementation choices, as well as suggesting "guidelines" for implementing a conferencing system. Specific examples of conference types and user statistics are included as appendices. As a beginning, however, a brief review of some recent University history will be helpful in understanding why certain approaches were taken.

UNIVERSITY SETTING

Following the appointment of a Presidential (new president) Task Force on Information Services in 1982, we had been examining and evaluating the concept of electronic conferencing. In spring 1983, a committee recommended installation of a computer conferencing/electronic mail system. This was followed in 1984-85 by an Electronic Communications Committee, which assessed electronic mail and computer conferencing systems. This committee again justified the need, provided examples of commercial and specialized systems, and developed a general evaluation of four conceptual options (commercial computer conferencing software, consortium group software exchange, in-house programmed, and VAX based commercial electronic mail).

While no specific campus-wide system existed, several electronic mail systems were already in use at the University, generally with clearly defined user groups. These included POSTMASTER (on Prime), VAXMAIL (on VAX), COSTAR (on VAX), PROFS (on IBM), and several electronic bulletin boards (including a network of county to campus computer FIDO bulletin board mail transfers). Several departments also used BITNET and commercial electronic mail services for off-campus communication.

From summer 1985, major changes had occurred in central computing activities, including reorganization of all independent computing and communication units under one person; shifts to a different vendor for administrative computing; purchase of new software and a new database for administrative computing; shifts to another product line for instructional and research computing; and installation of a mini-supercomputer. A 2-year project began in spring 1987 to replace/upgrade the telecommunications system (rewire each office to include data and voice lines as well as new telephone equipment and data networks).

In the six years that ended December 1986, the University had acquired about 4000 microcomputers, 2100 terminals, and 1000 modems. A number of faculty, staff and students also owned private units (both at home and work). To add further importance from another perspective, an ongoing strategic planning process had also identified campus communication and information flow as a weakness.

In summary, we had recently experienced 1) very significant hardware and software shifts for mainframe computers, 2) reorganization of major computing and communication units, 3) purchase of a number of terminals/computers, 4) greater technical capability for improving on-campus communication, 5) formal committee studies of computer conferencing and electronic mail options, and 6) recognition and admission of inadequate campus communications. Thus, we were in a special position to implement a computer conferencing-based communication system; but we were still learning how the new organization would work, had suffered future shock and burnout from so many recent computing changes, and had no "culture" on campus on which electronic communication could build. We did have a few experienced individuals and several broadly based campus champions of the concept.

CONFERENCING SOFTWARE SELECTION

The Electronic Communications Committee report of spring 1985 evaluated 95 commercial and non-commercial electronic mail/conferencing systems and, based on required/desired features, developed a list of attributes for many of these. Using these data, a group of 4 reviewed conferencing systems for central facilities available at the time, including CONFER, EIES, PARTICIPATE, PARTICIPATE, CAUCUS, COSY, COM, and e-FORUM. Because of hardware requirements and major features, this list was reduced to 3: CAUCUS, COSY, and PARTICIPATE.

After a 25-member group reviewed these finalists (for documentation, individual account signon, evaluation summaries, and group demonstration/questions), CoSy from the University of Guelph was the final selection. The 2 most important criteria were 1) capability for common conferencing activities and 2) ease of learning for beginning and advanced users. VAX/VMS hardware was also chosen to run the software (another hardware option was IBM 4381). The full evaluation list is in Table 1.

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Table 1. Selection Criteria

High Priority	
Company	(reputation, years product available, financial status)
Ease of access	(by multiple devices and including microcomputer transfers)
Ease of using	(by experienced and novice users)
Hardware	(requirements and resource demands)
Help files	(variety, size, content, ease of understanding)
Learning ease	(by experienced and novice computer users)
Limitations	(relative to our desired features or software function)
Mail portion	(ease of use/capability of mail as separate function)
Missing features	(any common conferencing features not present)
Required changes	(needed before possible purchase)
Screen clarity	(general format and information provided)
Medium Priority	
Costs	(initial, revisions, updates, additional copies)
Grapevine	(what others say)
Manual	(type and clarity of hardcopy documentation)
Other installations	(number and types of experiences)
Pending revisions	(near term changes planned by vendor)
Uniqueness	(special software features compared to other products)

All evaluations had significant involvement by users, as well as those responsible for systems analysis, documentation, and training. Participants, selected from various campus administrative units, included both faculty and staff. It should be noted that the VAX/VMS version of CoSy was in the process of final conversion from the UNIX version; accordingly, we were able to influence the inclusion of additional features (at additional expense).

IMPLEMENTATION

The CoSy implementation will take an estimated 9 months (this paper was developed at the 7 month stage. In the sections that follow, specific aspects of the implementation are given, with an overall schedule in Table 2.

Table 2. Implementation Schedule

Month/year	9/86	10/16	11/86	12/86	1/87	2/87	3/87	4/87	5/87	6/87
Install software (test)	*****	**								
Install software (open)		****	****							
Educate key personnel		****	**							
Early test groups (6)			*****	****						
Campus seminars/articles		* *					* *			
Additional groups (10)					*****	*****	****			
Feedback (formal)			*				*			
Open to all users							*			
Pilot instruction courses							****	****	****	****
Install new version										***
Implementation complete										*

System Configuration

CoSy is connection load-balanced among 3 clustered VAX/VMS 11/780 computers, also used for general support of computer instruction classes. All users must log in through a captive VMS account, with individual identification determined by CoSy. Access is gained by a large data switch (IDX-3000) and is accessible by direct connection, modem, or Sytek broadband network. Because of security, general user accounts cannot now access CoSy. Campus users are not charged for use but must have Access Forms.

Organization and Personnel

Formal CoSy installation is provided by the Division of Telecommunications, Center for Computing and Information Technology (CCIT); other divisions within CCIT provide user help and documentation. A 4-member management team (Director of Telecommunications, Telecommunications Systems Operator, User Support Manager, and Chair of User Advisory Committee) manages the installation, with the help of an 8-member User Advisory Committee, about 5 staff, and peer assistance by CoSy users. Early months of installation required an estimated 2.0 full time equivalent people (FTE); an estimated 0.5 FTE is anticipated after maintenance level is reached. Early time commitments included making some software modifications, identifying and printing documentation, developing a conferencing culture, establishing administrative procedures, marketing, and isolating software bugs/desired features of the new CoSy VMS version.

To establish an adequate user base, key people in major institutional units were asked to help implement their areas (find new users, get them started, provide advice to CoSy management team). This time investment around the campus probably adds another 1.0 FTE to implementation costs. As others accept CoSy, its use is being "institutionalized" to ease addition to normal activities.

Policy choices

Several policy choices, made early on, have guided the implementation process. New issues are generally addressed on demand, and current policies are modified in consultation with selected key users. Major policies are --

1. Initial users to be added as groups
2. Groups or units to include all administrative level
3. Particular attention to be given to selected high-impact groups

4. Education about "conferencing culture" to be very important
5. Network of campus-wide "helpers" to be developed
6. Organization and policy to remain flexible as changes occur
7. Moderator status to be limited until "culture" is established

Training

In the early trial period, training support was largely informal, unstructured, and self-administered; that is, scheduled Cosy classes were not integrated into the standard CCIT computer training series. Instead, trial groups were given one-on-one and customized small-group sessions. Conferencing culture and the anticipation of organizational or behavioral change was stressed in the sessions. Online tutorials were installed as self-administered training aids. By design (or accident), this scheme worked better not only for training purposes but also for "selling" conferencing during the introduction phase of implementation. Moreover, the early involvement of high-level administrative users dictated that specialized (vs packaged training) be provided.

Current training support has evolved into several forms:

- Self-help training by online tutorials for beginning and advanced users
- Quick documentation guide and reference materials (mailed to all new account holders)
- Availability of a "consultants" CoSy mailbox or regular telephone for help (621-HELP)
- Live training delivery now provided in several ways:
- Departmental sessions arranged and led by the user departments, with CCIT providing facility or staff assistance
- Regularly scheduled training sessions sponsored by the Center, aimed at providing instruction on mechanics of using CoSy
- One-on-one training and special sessions arranged by request, normally for university executives or groups/departments requiring customized training support to expedite CoSy adoption in their department

Most user training is by online tutorial, with ability to read instructions several times. Material is divided into an elementary tutorial for new users and a more detailed and lengthy tutorial for advanced users.

The group training approach, especially if arranged by the user departments, has advantages:

- Commitment from a departmental leader precedes training
- Group members practice with one another, not strangers
- Session can be designed to be task-oriented immediately (e.g., practice with a conference will be continued on the job)
- A network of peers who can help each other with CoSy use is started
- Drawing trainers from user departments reduces staff training costs

The implementation team noted that the training design per se was not as critical in speeding up CoSy adoption as was the user's perceived need to use the system because it has become job-related. The most active conferences involve groups where management "legislated" its use as an official communication tool or important job-related information is being exchanged online.

Information provision

Several approaches were taken to provide information on conferencing throughout the campus.

1. Campus seminars

Computer conferencing was introduced to the campus in 2 seminars, open to all faculty, staff, and students. The first, which preceded the 4-month trial implementation phase, aimed at introducing the audience to conferencing concepts and culture, rather than mechanics of the CoSy system. Possible uses, others' experiences, and the implementation plan were presented in the 4-hour seminar, which ended with a very brief Cosy demonstration.

The second seminar was timed for the end of the trial period, since the campus was already familiar with CoSy implementation and many were eager to start using the system. The seminar was therefore designed to be more action oriented than lecture intensive. Seven workstations were set up to demonstrate CoSy use with different access equipment (PC's or terminals) and connection (direct or dialup). A help desk was available to answer questions, provide documentation, and process account application forms.

Both seminars included off-campus consultants and on-campus users. By the second seminar, enough users were on CoSy to enable campus-wide participation in seminar content planning and demonstration sessions.

2. Publicity

"Cosying" quickly became a household word on campus during the trial period. Those who used it heavily became active promoters; word of mouth, informal group exchanges, small-group presentations, and actual system use were natural publicity channels. Coverage was also obtained in established publication channels such as the University staff newspaper, campus computing newsletters, bulletins and flyers, and the formal University administrative mailing service (deans, directors and department heads). Information packets intended only for trial groups migrated to many others, widening curiosity and interest in CoSy.

3. The "Ombudsman"

The implementation team succeeded in reaching many campus departments and users through the efforts of a strong "ombudsman". Initially a recognized academic and administrative campus leader became the CoSy spokesperson in many department meetings, special presentations, small-group discussions, and task groups. These sessions included helping particular administrative units or groups understand how they might use CoSy in normal activities (with examples developed when necessary). Subsequently, a small group of special ombudsmen emerged to carry on these efforts. From small cafeteria discussions to high-level administrative meetings, the advocate and ombudsman stirred interest in this new communication tool.

4. Newsletters

An online newsletter (about 1-2 screens) and a hardcopy newsletter (2 sides of 1 sheet) highlight activities. All CoSy account holders receive the hard copy, directed more at recent users or those who may not have tried the system.

5. User Feedback

Questionnaires were distributed to groups at the end of the trial period. Of the 116 active users (signed in at least once the previous week), 83 responded. Comment highlights include --

- Most users learned about CoSy from colleagues (65%)
- Most learned by self study (66%)
- Most thought they were "average" users (78%)
- Most had no problems getting started (71%)
- Most used personal computers for access (84%)

Asked the single best thing about CoSy, 30% said ease of use; the single worst thing noted was verbose editor (22%) and slow response (19%). Useful support features were new user tutorial (60%), Quick Start Guide (55%), Reference card (50%), online help (50%), and advanced tutorial

(48%).

Several open conferences also serve as repositories for continuing CoSy feedback and discussion (Table 3).

CoSy Consulting (a "consultants" account) was also created to provide a mailbox for posting questions on use; a designated consultant logs in at least 3 times a day. As need expands, consultants will be added to this activity. At the University of Arizona, the term "consultant" is used for help on any computing problem, so that term was selected as the CoSy help account. The consultants' account is an active participant in general informational/support conferences.

Table 3. Feedback-Related Conferences

Name	Description
.help	submit questions on CoSy usage
.hints	general CoSy usage hints
apply.cosy	open discussion of possible CoSy applications
bugs.cosy	report CoSy bugs
feedback.cosy	suggestions and/or general feedback re CoSy
moderators	Discussion area for conference moderators

Note: bugs.cosy entries are periodically submitted to the U of Guelph

When appropriate, consultants also respond in conferences such as .help, feedback.cosy, bugs.cosy, and culture.

Most of the training load is addressed by tutorials and peer help, with relatively few questions coming to consultants. Typical questions include help with communication or terminals, initial entry into CoSy, using editors, and a few system commands.

APPLICATIONS AND USE CHARACTERISTICS

The initial user community was identified as groups, and attempts were made to get new groups that had some overlapping membership with existing ones (Table 4). After a short time, group representatives requested additional user accounts (all were granted as long as the group had a need to communicate).

Table 4. Growth Rate of Arizona CoSy System

date	moderators	confs	listed members	key events
Sep 1	4	0	4	Testing early release v 1.0
Nov 1	4	10	4	Testing release v 1.0
Nov 15	10	15	10	Open to select groups
Nov 30	15	19	40	
Dec 31	23	32	122	
Jan 31	27	46	204	
Feb 28	50	50	400	Open to anyone if interested
Mar 15	71	65	504	

When new accounts were entered, the materials sent to the user included a page on why group accounts were important, how to plan group meetings, the importance of proper equipment, and a list of critical success factors for conferences. The types of current (March 1987) conferences are in Table 5.

Table 5. Types of Conferences

Type of conference	Total Number	Number Open
Administrative	16	0
Conferencing culture	3	3
Information sharing	20	18
Implementation of CoSy	23	12
Teaching*	3	1

* We implemented a second version of CoSy entirely devoted to instruction (actual teaching activities); the use of this version is just beginning.

Programs were written to produce 2 weekly CoSy use reports, which establish a "pulse" on system growth related to connection load on the VAXen. Generic user trends were established. Data and trends observed will be used to plan future resource expansion to support the growing user population. The first report is a histogram plot of the number of simultaneous CoSy sessions in use versus time of day for the entire week (see Appendix A). Currently, (early March 1987) the average daily load of about 7 to 8 users during prime time (400 accounts have been established, out of which approximately 200 used the system in the previous week). A peak number of 18 CoSy users occurs briefly.

The second report provides a weekly session summary and histogram plot of number of sessions vs length in minutes. Distribution of sessions has been remarkably consistent over the past 3 months (a growth from 40 to 200 active users). Average CoSy login session is currently 13 minutes long and average time per active user is 2 hours a week, representing "generic users" for planning purposes. Individual users exhibit fairly large variances around these averages.

CURRENT ACTIVITIES

Penetration of the University Community

Approximately 35% of the administrative units on campus have at least one representative on CoSy, while some units (departments, colleges, administrative offices) have their entire faculty or staff on the system. Current efforts are focused on improving the efficiency of these units, as well as continuing educational efforts toward establishing a conferencing culture.

After the second seminar, we held a special training session for moderators, which doubled the number of those having this privilege. The moderators will increasingly be used as key managers/ users and take on an added role in educating users in areas other than the simple mechanics of conferencing.

A pilot course has been established to allow faculty to observe (and participate) in a teaching setting to determine if they would like to use the system in their fall 1987 instructional activities. In addition, two instructors will use CoSy as an adjunct to their classes in spring 1987 to gain experience under realistic classroom conditions.

Finally, a conferencing evaluation committee was established to review both the implementation and the use in teaching situations.

Impacts on Users

While we have not had sufficient time to fully understand the changes brought by installation of the conferencing system, there are already some clear changes in behavior. The major impacts experienced so far are --

- increased participative involvement
- increased "committee" membership with a formerly small committee becoming new executive committee but adding more "general" members
- decrease in phone tag among participants
- fewer face-to-face meetings
- decrease in lost conversations among participants (a lost conversation is one that takes place between members of a group SUBSET but contains information the ENTIRE group needs to hear)
- increased information between different user groups
- information sharing and request for comment prior to decision making

Checklist for Successful Implementation

The situation at the University of Arizona is not unique, but our experiences cannot be simply extrapolated to other sites. However, we have learned a few things and confirmed some other's observations. A checklist of possible success factors is in Appendix B.

Risks and Pitfalls

There are certain situations that are risky during the implementation process. A few we found of particular significance included --

- Failure to achieve a critical mass of users fast enough to encourage routine use of the system
- Allowing a large amount of bugs which impact user impressions to remain in the system
- Assuming the package has reasonable message security for your application. Check out the message data security and protect it yourself.
- Eliminating physical meetings entirely; this type of meeting is still important.
- Neglecting to keep an eye on computing capacity. Project success can be adversely affected by long delays, downtimes, and login queues.
- Adding too many new users too soon, so the old users cannot be helped adequately.
- Allowing the culture aspects of education in conferencing use to lag, by giving too much attention to new user signons.

CONCLUSIONS

The University of Arizona took over 3 years to evaluate various aspects of electronic mail and computer conferencing, although the need for both was clear early in the process. This delay was caused by major organizational shifts, new administrative hardware and software installations, and changes in the communication system. This amount of time, however, allowed an opportunity to educate portions of the campus community on relative merits of computer conferencing.

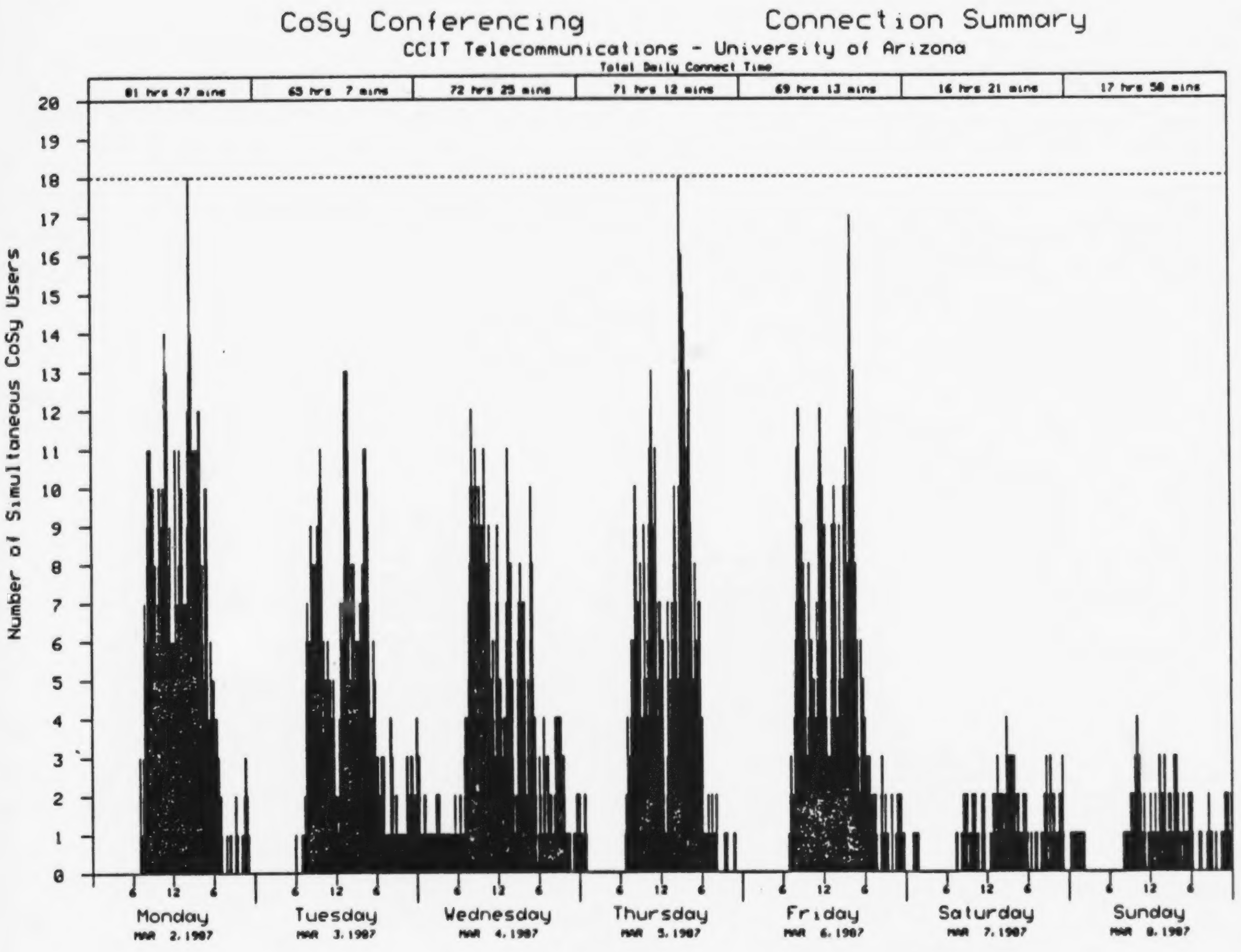
During a four month period we installed the CoSy conferencing system to penetrate about 35% of the administrative units on campus, with over 400 users. The approach included 1) focusing on groups with an existing need to communicate, 2) educating groups on conferencing impacts as well as technical needs to be functionally literate, and 3) adding principal members of institutional units to establish a network representative of the campus. The campus view of computer conferencing as a tool has become increasingly favorable. The main drawbacks hampering it use as a tool are limited computing capacity (of the current hardware) and unresolved software bugs in the initial VAX/VMS version; remedie are underway for both of these limitations.

Appendix A

USER STATISTICAL INFORMATION

COSY CONFERENCING CONNECTION SUMMARY

Week of March 2-8, 1987



CoSy Conferencing Connection Summary

CCIT Telecommunications - University of Arizona

USER STATISTICAL INFORMATION (Continued)

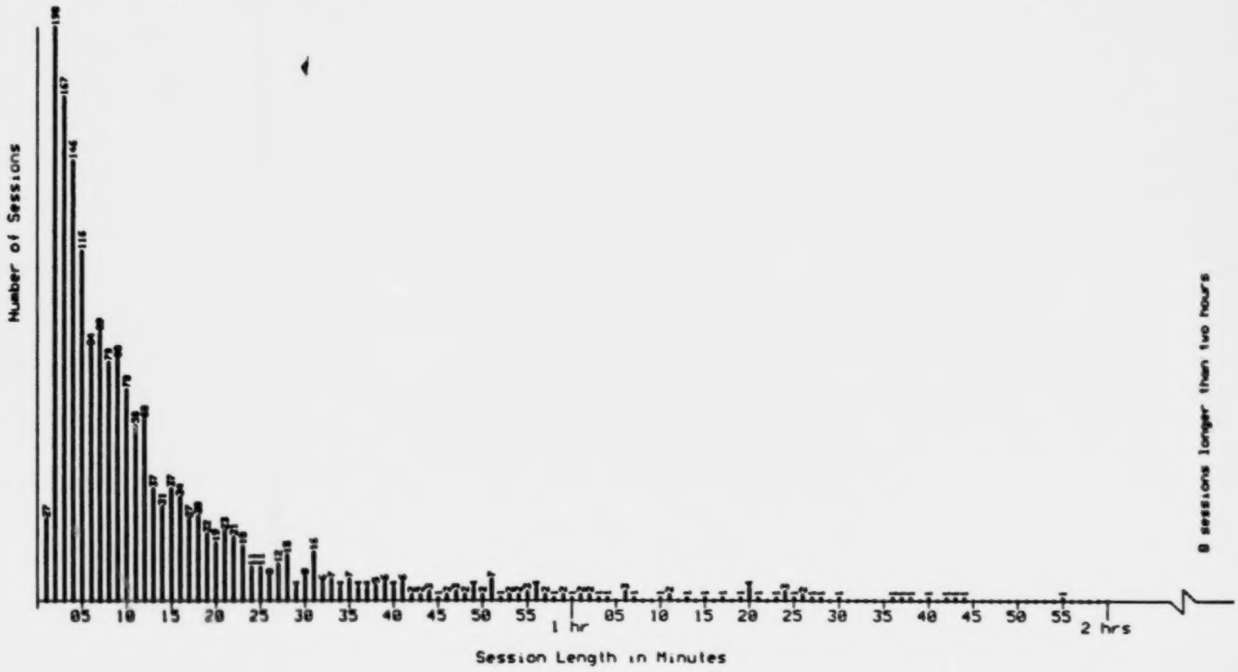
COSY CONFERENCING SESSION SUMMARY

Week of March 2-8, 1987

CoSy Conferencing   Session Summary

CCIT Telecommunications - University of Arizona

DAY	DATE	# SESSIONS	# USERS	TOTAL TIME	AVE PER SESSION	AVE PER USER
Monday	MAR 2, 1987	320	121	80:46	:15	:40
Tuesday	MAR 3, 1987	277	121	63:27	:13	:31
Wednesday	MAR 4, 1987	319	117	71:41	:13	:36
Thursday	MAR 5, 1987	355	133	70:06	:11	:31
Friday	MAR 6, 1987	320	135	67:46	:12	:30
Saturday	MAR 7, 1987	57	20	16:13	:17	:34
Sunday	MAR 8, 1987	47	23	17:47	:22	:46
Week summary		1695	199	307:46	:13	1:56



Appendix B

CHECKLIST FOR SUCCESSFUL IMPLEMENTATION

The University of Arizona provides an example of a large, diverse institution with only limited electronic mail service and no computer conferencing "culture". Thus, the selection of success factors will differ from institutions where electronic communication experiences were more ingrained. The following checklist is based on our experiences:

- Identify and recruit key personnel who have the willingness and political power to encourage others to use the system.
- Create a few interesting open conferences for general use and discussion (as well as fun) so new users can see messages, even if not involved in any mainstream "working" conferences at the moment.
- Once key people are adequately exposed to the system, push for a critical mass of users - if a new user can't converse with the right persons, the system will be abandoned. Critical mass is very important. More groups are added to mix with existing groups to fill gaps.
- Initially add groups of related users who have already established needs and are communicating. Conferencing used as a tool to supplement existing groups works well.
- Be very conscious of how conferences, messages, and structure look during the early stages. People tend to mimic pre-existing examples. This is the best opportunity to guide overall system form.
- Remember each user belongs to a different set of conferences and thus sees a different picture. One may think the system is used heavily while another sees little activity.
- Strongly encourage free format personal resumes, which help greatly in establishing a user id as a person. We encourage users to include both work and outside work interests in their resume.
- Encourage users to keep in the back of their minds that messages should generally be written with an eye toward present, as well as future, audiences. This is a notable difference between conferences and face to face meetings.
- Connectivity is critical; users need convenient, daily access to equipment before they get accounts.
- PC communications software: recommendations/guidelines are helpful, especially if users are non-mainframe users.
- Continuing user involvement in the implementation process, identification and involvement of user advocates system .
- Recognition and publication of technical limitations of the system, including known bugs, peak load impacts on response time, processing or file quotas (if any).
- Effective moderators are important! Moderator support should be identified and provided.
- Conceptual discussions of conferencing should be continued beyond the initial

implementation phase (e.g., culture, etiquette, conferencing misuses, blunders).

- Encourage innovative uses of conferencing to widen its appeal and usability.
- Provide for long-term planning of support, including computing capacity, accounts handling, general support services, data security, data archiving and purging policies, maintenance issues, compatibility with other communication/mail systems.
- Critical mass participation is necessary; critical mass dissatisfaction is potential if system support is weak.
- Continue logging or monitoring group experiences to provide basis or framework for evaluating upgrades and/or alternative conferencing systems in the future.

Electronic Communication and Crime

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Abstract

Much attention has been given to the positive aspects of using electronic communcation for educational purposes. It is a wonderful tool. But there is also a dark side to communications technology. Information ranging from credit card numbers to A-bomb plans to "electronic hate mail" is being passed around on our phone lines. Examples of the criminal use of computer communcations are given. The legal, moral, and ethical dilemmas raised are discussed briefly.

Computer Conferencing: A Value-neutral medium

Many observers of computer communications have noted that people will say things in "computer conversation" that they would never say face to face. Joseph Weizenbaum, the creator of the famous "ELIZA" psychiatrist program was dismayed to find that some perfectly normal people actually preferred his creation to a real human psychiatrist. Indeed, notations like the famous "rotated happy face" :-) have evolved to soothe feathers ruffled by brusk email messages.

Forbidden Knowledge: The Electronic Garden of Eden

Taking this observation one step further, we find that people are putting truly dangerous information on computer communications sytems. The problem goes far beyond the odd dirty joke or obscenity. Consider these examples:

- A BBS allegedly operated by a Ku Klux Klan chapter gives the names, addresses, a license plate numbers of "enemies" including rabbis, suspected FBI agents, etc.
- A BBS in Calgary contained plans for causing the city's Light Rail Transit train to crash
- Several BBSs contain explicit directions for making drugs such as methamphetamine ("speed".) The level of detail goes right down to "don't smoke around the ether."
- Lockpicking lessons are available via BBS's "philes"

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Of course, some of the people who post these wicked transactions probably talk about similar subjects with their friends. But there strong anecdotal evidence that it is the act of putting this "forbidden information" on the computer that is what's really attractive. In other words, they don't plan to make speed, crash the LRT or pick locks. They just want to know how, and to earn recognition by flaunting that knowledge.

This desire to "have the knowledge" is of course the "Hacker Ethic" made famous in books and articles over the years. In Hackers, Stephen J. Levy explains that the "hacker ethic" dictates that those who really understand technology should have access to it.

The goal of the "good hacker" was to develop an intimate knowledge of computers and, well, if that inconvenienced a few of mindless users running Lotus 1-2-3, that was just too bad.

Real Phreaks Don't

"Phreaks", (being a combination of "phone" and "freak,") is the term that people who cheat the phone system use to describe themselves and each other. In a fascinating BBS transaction entitled "Real Phreakers Guide Vol 1," created by Taran King and Knight Lightning, we learn that:

- Real phreaks done just leech off of BBS messages for their codes (telephone access information - ed.)

- Corollary: Real phreaks know the codes posted on BBS's are the most used and are probably the closest to being unsafe. Also it is a known fact that phed occasional plant trap codes (codes with traces) to catch the phreak at work.

- Real phreaks don't bust other phreaks (for any reason)

- Real phreaks don't have any trouble obtaining numbers to their local long distance service dial-up.

as well as such fascinating tidbits as:

- Real phreaks don't watch Saturday morning cartoons

- Real phreaks don't listen to Duran Duran...ever!

- Corollary: Real phreaks change the channel with swiftness if they hear any gay group come onto the channel they are listening to.

There's obviously a whole wierd world going on out there!

The wages of sin is...a $2700 phone bill.

A single mother in Calgary has had her phone service terminated because her precocious, non-phreak son dialed up BBS systems across North America to the tune of $2700. Often, of course, the offender simply "phreaks" the phone system. Another approach involves "network hacking." The infamous "Dalton School Gang," a group of high school students in New York, simply tried successive address on a network until they hit paydirt. They were able to break into the Sloan Kettering Medical Center's computer.

The packet switched network operated by Telecom Canada, Datapac, is about to allow the making of local phone calls at the distant end of a packet call. This will be a boon to many, including those who wish to use distant BBS systems within Canada. It will also provide another way for the users of these systems to avoid the long distance telephone bills noted above.

Sysop Liability - Now there's a stupid idea!

The "Sysop" (System Operator) is the person who provides the computer and phone line for a Bulletin Board. There have been seizures of computer equiment belonging to operators of bulletin boards that give explicit counsel to perform illegal activities. According to one BBS trannsaction, proposed regulation in the US involves a Federal law that would :

-require registration of all BBS's
-require Sysops to keep logs of all users' verified names and addresses
-require Sysops to keep logs of all msgs.
-criminal penalities for Sysops who allow illegal posting.

This is clearly silly because:

a) same info can, and is, distributed by floppy disk. The regulation would only move the problem to the mails.

b) encryption could be used to disguise the information. Consider thissimple scheme: if A wanted to leave B a Visa number he could simply leave a message and have word lengths stand for digits, e.g.

Mary had a little cow... would be 4316 3.... etc.

Anyway, there are other laws that can be used to combat electronic crime. Fugitive Ray Beam, Jr. of Dallas, Texas is the alleged mastermind of the Ku Klux Klan's "hate bulletin boards." He has been charged with conspiracy to overthrow the government and plotting to bomb Federal offices. (USA Today, 87-04-27, pg. 3A.) So while the communications may not be a crime (and may well be protected in the U.S. by First Amendment right to Freedom of Speech,) the conspiracy involved may well be criminal.

Virus by Email

One of the more subtle and insidious computer crimes relates to the sending of a "virus" through electronic mail. This can be done on some systems by inserting control characters that reprogram the "soft keys" on a keyboard.

In one case, a reporter at the Calgary Herald sent a piece of "electronic hate mail" to his editor every morning. The result was to print a rude, nasty message every time the editor logged on to the paper's production system. It might just as easily have issued a command that would erase all the stories in the editor's section of the paper. In other words, once the embedded message took effect it had the same power as the editor himself.

The only defence would be to disable the intelligence of the editor's terminal by turning off the soft keys. Indeed, when this vulnerabilty was reported a number of corporate computer users actually opened their machines and yanked out cards, turning their expensive Ambassador terminals into dumb teletypes!

Coping with communications crime

Here, in a nutshell, is what happens now. Police watch BBSs and use means, other than communications to gather evidence. The actual activities are what is prohbited, not their discussion.

This laissez-faire attitude may prove unacceptable in some societies. (It already is in the Soviet bloc, where hacking is clearly a dangerous_to_your health activity!) The latest pornography legistation introduced May 4, 1987 in Canada includes what many (e.g. some opposition leaders feel) are "Victorian" restrictions. What is acceptable in a movie theatre today may not be if this bill is passed. By analogy, discussions on computer networks that are now tolerated may at some point "cross the line" and become socially unacceptable. It will be a fascinating area to watch, and one that promises a great deal of entertainment. That is, of course, provided nobody uses the plans for building an A-bomb that can be found on many BBS's!

Distributed Conferencing Systems:
A Practical, Easily Implementated Architecture

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Second Symposium on Computer Conferencing and Allied Technologies
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ABSTRACT

Techniques and protocols for tying together multi-location conferencing systems have been discussed for many years, but often become bogged down with the need to attempt to cover every situation, and provide unique layers of communication between systems.

This paper will present a simplified architectural approach to providing user- transparent distributed conferencing function based on the concepts of **peer to peer relationships**, whereby two or more independent systems can share comments entered locally into each system in a common conference - topic discussion without redundancy, and use of **existing message delivery protocols and networks** to carry the comments between systems.

Examples and experiences from current work being undertaken in this area by the University of Guelph CoSy Development Group will be given.

THE NEED FOR DISTRIBUTED CONFERENCING

The present implementation of most computer conferencing systems is a centralized mini/mainframe based service, accessed through incoming telephone and packet network circuits. Electronic mail has been evolving from a similar central server model, to one where the messages are carried from the originator's machine to the recipient's machine by a network, transparent to the user.

Like Email, users of computer conferencing are beginning to demand the functionality of a distributed conference, so that conferencing can be done with the convenience, and low cost, of a local connection, and without having to log on to a number of machines to communicate with various groups of colleagues. The software that provides this functionality, will be the software of preference for a large percentage of future system users.

What is Distributed Conferencing?

Distributed conferencing is best described from the user's perspective. Say there are 5 machines running a distributed conference, connected to each other by either continuous or dial-up "back door" network connections. On each of the 5 machines, there is one common conference, each with a local roster of participants. Each local user connects to the conference on their local machine, and can read comments entered not only by other local colleagues, but also by participants at the other 4 sites. The sites are not connected together in "real time"; instead, gathering and reordering the accumulation of comments takes place on a regular basis, such as overnight.

A key to the issue of distributed conferencing must be user transparency to all the intersystem communication and updating tasks being performed. As far as the local user is concerned, all participants, at all of the 5 sites, are participating as though they were connected to one central machine. The only difference is that the messages from remote sites appear to be added at one time, following the overnight update.

SOME DESIGN OBJECTIVES

Separation of UA and MTA Function

The CCITT X400 standards (1) specify two components of the software necessary to enable coupling of remote electronic mail systems. The first is the User Agent (UA), which is the software that lists items in the inbasket, provides a text preparation editor, provides facilities for reading, storing, and retrieving messages, and other general services to assist the user in managing both incoming and outgoing mail.

The second component is the Message Transfer Agent (MTA), which takes the text block, with address, from the UA, and sends it via a network or some other connection to the MTA affiliated with the address of the recipient.That MTA then passes the message to the recipient's UA, which allows the recipient to read, reply, file, etc.

This separation of function can be profitably applied to the architecture of distributed conferencing, if the conferencing software is thought of as just another UA, and the data containing the distributed conference update information is contained in an Email message handled by existing MTA to MTA protocols. Thus, for the first iteration of a distributed conferencing implementation, existing software that handles machine to machine Email transfers, such as the bitnet mailer, EAN, uucp, or the Fido BBS dialup software, may be used.

However, most of these are designed for a single transport medium (ie bitnet leased lines, Fido dialup telephone), and what will ultimately be required is a MTA that can select, based on destination and cheapest cost, which of the communications transport vehicles should be used for each connection, and perhaps even a fallback procedure if the primary one is unavailable.

Pitfalls in Distributed Conferencing

One of the pitfalls stated in previous work on distributed conferencing (2) has been the "looping" problem. This can be described by the following example. Message 40 is added at system A into a distributed conference also operating at system B. At update time, A sends message 40 to B, and B adds it to its conference. B then scans its own list of new messages, sees the message added from A, and has no way of determining that it was not locally added. B then sends it back to A as a new message. A adds it as message 41, and sends it back to B, etc. While solutions for this simple example can be easily seen, the problem is more difficult when a number of sites are maintaining a common distributed conference.

A Tough Decision: User Function versus User Confusion

While the desirability of providing distributed conferencing to users is clear, what is the cost we must pay in making the user inferface more complex?

The use of computer conferencing as a way to enable and facilitate group communication is growing rapidly among the segment of the population who might be classified as "computer illiterate" or "infotechnically naive". This is the class of users who bring a critical mass to a computer conferencing system's population, and by their presence and participation make it time effective for all participants to make use of the system.

However, do these people have intuitive ideas on how networks function, or are they able to feel comfortable with a multi-level network address? The answer is an emphatic NO, and system designers must do everything possible to make the operation of the distributed conferencing function totally isolated from the commands the average user must use. Messages from members of a conference/topic on a distributed remote system must appear intermixed with messages from local members on the local system, without special connection or display commands being required, while at the same time, comment reference chains are maintained and propogated correctly.

The operation of the distributed conferencing function must be implemented without any impact on a naive local member, so that his communication task, through the conferencing system software, can be kept as simple as possible.

Goals of an Ideal Distributed Conferencing System Design

1. Communication between remote conferencing systems should be done by asychronous electronic mail, delivered through existing message transfer agents (MTAs) using existing network, packet or switched network connections.

Reason: Good electronic mail delivery systems already exist. It is not desirable to reinvent the wheel.

2. All systems are peers.

Reason: Non-peer systems imply management control of the process, including hierarchy tables, people involvement, etc. This may not be a concern when only a few sites are connected by distributed conferencing, but will rapidly break down to chaos as the number of systems grows exponentially.

3. Control and permission to establish or connect to distributed conferences must rest with the conference moderator, not the system administrator.

Reason: Administrative overhead must be kept to an absolute minimum. The onus for establishing connection must rest with the person with the highest motivation, namely the conference moderator.

4. Interchange of conference comments must be possible across all brands of computer hardware, operating system, and conferencing system software.

Reason: The widespread adoption of of distributed conferencing will be severely retarded if intersystem communication is restricted to the proprietary network or operating system restrictions of one computer manufacturer.

5. Looping, or multiple copy additions must be prevented by a simple means.

Reason: A scheme for uniquely identifying a message, within the context of a distributed conference and topic, is possible without attempting to create a universal message number, or require extensive processing to scan text blocks for congruency.

6. The overhead of maintaining records locally, on all participants in a distributed conference, should not be necessary.

Reason: A simple automated request for information to the remote system will avoid outdated local information, and leave responsibility for security and privacy in the control of each site.

A PROPOSED ARCHITECTURE FOR DISTRIBUTED CONFERENCING

The balance of this paper describes a scheme through which two or more conferencing systems could support parallel conferences. Update text and data exchanges between the systems would be handled by a distribution agent process, operating on each system, which would manage the interchange of information, and the update of the local conferences so connected with the remotely originating comments.

The distribution agents would format, send, receive, and interpret electronic mail messages containing the update information necessary to keep the various peer systems in a distributed conferencing logical connection in synchronization with each other.

The Distribution Agent

The distribution agent is the interface through which conference update information is transfered from one distributed conferencing system to another. The distribution agent creates and formats an update mail message to be sent to another system, for each conference identified as a distributed conference. The distribution agent also receives similar mail messages from other remote systems, and arranges for the comments contained in the message to be added to the appropriate topic in a conference, setting up the reference pointers and local reference numbers as it does so.

Distribution Agent - Creation of Outgoing Messages

The creation of outgoing update messages would normally be triggered by a clock event, set, for example, to 2am. When called, the distribution agent would look at the system file which contained the names of all conferences which had a distributed connection.

For each conference name entry, the distribution agent process would open a mail buffer, and join the conference. For each topic in the conference, the distribution agent would compare the newest message pointer to the highest message number sent in the last update.

If new messages have been entered locally since the last update was sent out to that particular remote site, then the new messages, together with their header and upref information, would be transferred to the mail buffer. When all new messages in all topics within that conference had been transferred to the buffer, the buffer would be closed, the email block sent to the address of each remote distribution agent logically connected to the conference, and a tenative "last comment sent" pointer set for each topic. This tenative pointer would be confirmed when the acknowledgement message returned from the receiving site.

The distribution agent would then move to the next conference name on the system list, until all had been updated. In most cases, a distributed local conference would only send and receive updates from one or two remote systems, which in turn might be connected to other systems. However, as many entries as desired may be placed in the conference distribution list. Redundant or duplicate comments are easily filtered out using the message identifiers and hashing scheme described below.

Distribution Agent - Processing of Incoming Messages

Incoming messages to the distribution agent are of four types:

- Data update for a specific conference
- Acknowledgement of successful update from remote system
- Requests & acknowledgements for distributed conf setup
- Request for information

a) Data Update

The distribution agent must process incoming mail messages as they arrivefrom remote sites. Some of the functions required are:

- validate that permission to update is in place (moderator)
- generate error mail messages
- check for topic match between update and topic list. Create a new topic to hold an incoming comment if necessary.
- create a hash number, using the authorid, authornode,date and time fields. Check that an identical hash number does not exist in any of the previous messages in the topic. If match found, discard the incoming message. If no match found, add the message to the topic.
- create a second hash number on the data contained in the upref line. Check, from latest to earliest, if the upref hash matches any previous message. If a match found, create the appropriate local reference pointers on the new message and the referenced message. If not, include a line in front of the message such as "unable to resolve reference..."

b) Acknowledgement of Successful Update

Once the update to a conference has been successfully completed, an acknowledgement message is created by the distribution agent and returned to its counterpart at the originating site. The originating distribution agent then updates the tenatively set "last sent" message pointers to permanent "last sent".

c) Requests & Acknowledgements of Conference Setup

A number of message types will be handled in this category. For example, a moderator on system A may send a request that he be allowed to connect a parallel distributed conference on his system to one on system B. These types of messages must be routed to the "B's" conference moderator, requesting his permission or denial, followed by appropriate confirmation. Any moderator in a chain of distributed conferences can approve attaching another link in the chain to his local system....no "master" moderator exists. In addition to the permissions and acknowledgement messages, each distribution agent must exchange some address and password information between themselves so security can be protected when updates are performed.

d) Requests for Information

A user on a remote system may request information, such as open conference lists, participant lists, resumes, moderator names, etc. The distribution agent receives these requests, validates them, issues the appropriate conferencing system commands, assembles the information into a mail message, and returns it through the remote distribution agent to the remote user.

THE MAIL MESSAGE PROTOCOL

Specifying "standards" is never a satisfying task in an evolving application area - no sooner is the standard carved in stone tablets than a compelling reason arises to change it. Inflexible standards are soon cast aside, as implementors define their own extensions or improvements to fulfill new needs.

This section contains a suggestion for the format of the inner contents of mail messages exchanged between the distribution agents connected to distributed conferencing systems, so that prototypes of the code required to perform the necessary functions can be written, and testing of the concept of distributed conferencing given in this paper can get underway.

The protocol has its basis in the Simple Mail Transfer Protocol described by Postel (3). Changes or extensions to the suggested formats will undoubtedly be required; but hopefully the structure of the formats is flexible enough to allow changes without major program reworking of the protocol parser.

Each mail message body is expected to conform to the following lowest common denominator restrictions of many mail delivery vehicles, which may include:

*80 character maximum line length
*lines terminated by CR/LF
*only printable Ascii characters used
(hex 20 to hex 7E)
*maximum of 1000 lines in message

Each mail message normally represents the update for one conference, which may contain many topics. Because of message length restrictions, one conference update may generate several messages, broken at a comment boundary if possible.

Message Header

The message header contains the information needed by the **MTA** to deliver the message, and normally consists of the following fields:

To: recipient distribution agent address
From: originating distribution agent address
Date: date and time field
Subject:

This is the basic protocol of the widely used RFC822 standard. (4)

Message Body

The message body consists of two parts. The first part, appearing only once, contains information on the source and destination conference. The second part contains one or more blocks, each containing the header and text information of one comment from the source conference.

Four letter keywords, followed by one space or a carriage return, are used to identify the contents of the current line, or the nature of a following group of lines. Keywords are indicated in bold capitals below for clarity, but are recognized in any combination of upper or lower case. Required data entries are indicated by examples enclosed in <carats>. The carats are not included with live data. Keyword lines can be input in any order, with certain restrictions.

Part 1 of message body.

OCNM <micros.pc>	originating conference name
OCMD <jsmith>	originating conf moderator id

DCNM <microcomp>	destination conference name
DCMD <billyg>	destination conf moderator id
LENT <145>	total lines in this message body, from start

Part 2 of message body

HEDR <topicname>,<authorid>,<authornode>,<date>,<time>

where <topicname> is the name of the topic in the conference
<authorid> is the id if the comment author
<authornode> is the node id of the author's host system
<date> is the date of message creation (any format)
<time> is the hours, minutes and seconds of creation
(any format)
and the arguments are separated by commas.

UPRF <authorid>,<authornode>,<date>,<time>

is an optional keyword line, used where the comment to follow was entered as a reference to an earlier comment identified by the above information.

DATA <4>   where the <4> is the number of text lines to follow.
Line 1 of the comment body.......
Line 2 of the comment body.......
Line 3 of the comment body.......
Line 4 of the comment body.......

The combination of HEDR,UPRF,DATA and text lines is repeated for each new comment in each topic of the originating conference which was entered after the last confirmed update to the destination system.

A Sample Mail Message Body

The following example shows how the body of a mail message might look.

```
        [start of message body]
OCNM micros.pc
OCMD jsmith
DCNM microcomp
DCMD billyg
LENT 22
HEDR software,freddy,toronto4,Jun11-87,22:11:04
UPRF mbecker,toronto4,Jun11-87,19:45:06
DATA 2
I think Margaret's assessment of the needs in the area of user support is
correct.... but what will be the cost?
HEDR software,alanmac,london55,Jun12-87,08:18:24
UPRF freddy,toronto4,Jun11-87,22:11:04
DATA 4
Now hold on , Fred!
I think both you and Margaret are being a bit naive if you think that the support centers will be
willing to pick up the added costs of supporting an incomplete system... let's re-think this one.
HEDR hardware,bobriggs,arizona3,Jun11-87,21:14:44
DATA 3
```

Has anybody tried the new multi-port board from Computone? I hear from a friend that the CPU interrupt overhead is extremely low.

[end of message body]

MODERATOR DIALOGS

This section describes the dialog by which a moderator would make the arrangements to have an existing, or new, conference on his local system share the comments in a conference on one or more remote systems.

The responsibility for setting up the local connections for a distributed conference rests with the local moderator on each system. However, there has to be a "meeting of the minds" between the requesting moderator on the local system, and the granting moderator on the remote system before this can happen.

Agreement to set up a distributed conference can result from several different scenarios. For purposes of illustrating the basic ideas, let us assume that fredb is located at the guelph4 conferencing system node, and is the moderator of an existing conference named "micros.pc" on microcomputers. He has heard that a similar conference, named "micronews", moderated by sueball, exists at node queens6, and he wishes to establish a distributed conferencing connection.

Step 1.

Fred signs on the guelph4 system, and enters the moderator subsystem. He enters the name of his conference "micros.pc", and is recognized as the moderator of that conference. Fred enters the command to enter distributed conference setup information, and is prompted for the remote site name (queens6), the moderator ID at the remote site (sueball), the conference name at the remote site (micronews), and the mail address of the distribution agent at the queens6 site (distserv@cosy.qucdn.netnorth).

His local conference is tenatively set up to be a distributed conference with the remote site, but stops short of actually enabling the function. A mail message is automatically generated containing the same information on Fred's conference, and sent off to sueball at queens6, via the normal mail agents at each end.

Step 2.

Sue receives Fred's mail message, thinks tying the conferences together is a great idea, and enters her moderator subsystem to enter the equivalent information about Fred's site and conference name into her conference. This generates a return mail message to Fred, indicating that everything is go.

Step 3.

Fred takes the final step of enabling the previously entered data, and the distributed conference is underway.

Sample Moderator Dialogs

The following examples indicate how the moderator subsystem might be coded to prompt for the information necessary to establish a distributed conference. Responses are underlined.

a) Request a link to a remote system

```
Read:mod micros.pc
Mod:dist

(e)stablish,(c)onfirm,(d)elete,(m)odify,(s)how ?
Mod:e
        Name of remote site:queenschem
        Mail address of dist agent:distserv@queens6.qucdn.netnorth
        Moderator at remote site:sueball
        Conf name at remote site:micronews
        Confirmed and accepted by remote site yet?no
        OK to send message to remote moderator?yes

        Message requesting addition of distributed conferencing connection sent to
        sueball@queens6.qucdn.netnorth
```

b) Granting link as requested

```
Read:mod micronews
Mod:dist
(e)stablish,(c)onfirm,(d)elete,(m)odify,(s)how ?
Mod:c
        Name of remote site:guelph4
        Mail address of dist agent:distserv@guelph4.uoguelph.netnorth
        Moderator at remote site:fredb
        Conf name at remote site:micros.pc

        Confirmed and accepted by remote site yet?yes
        OK to send message to remote moderator?yes

        Message confirming addition of distributed conferencing connection sent to
        fredb@guelph4.uoguelph.netnorth
```

c) Deleting an existing connection

```
Read:mod micros.pc
Mod:dist
(e)stablish,(c)onfirm,(d)elete,(m)odify,(s)how ?
Mod:d
        Name of remote site:queenschem

        OK to send message to remote moderator?yes

        Message deleting distributed conferencing connection sent to
        sueball@queens6.qucdn.netnorth
```

d) Modifying an existing connection

```
Read:mod micros.pc
Mod:dist
(e)stablish,(c)onfirm,(d)elete,(m)odify,(s)how ?
Mod:m
        Name of remote site:queenschem
        Current information is as follows:
          <CR> to leave the same
          Mail address of dist agent:distserv@queens6.qucdn.netnorth<CR>
          Moderator at remote site:sueballbillyg
          Conf name at remote site:micronews<CR>

          Information updated.
```

e) Show current connection information

```
Read:mod micros.pc
Mod:dist
(e)stablish,(c)onfirm,(d)elete,(m)odify,(s)how ?
Mod:s
          Sites connected: queenschem
                           ottawa7
                           arizona3
          Name of remote site:queenschem
          Current information is as follows:
          Mail address of dist agent:distserv@queens6.qucdn.netnorth
          Moderator at remote site:sueball
          Conf name at remote site:micronews
```

WHAT IS REQUIRED TO IMPLEMENT THE ARCTITECTURE?

For an existing conferencing system, the following additions would be required to implement distributed conferencing.

a) Files (or file components)

At the conference level, for each conference with distributed peers:

> * a list of connected sites (usually no more than two) with mail address of the remote site Distribution Agent (DA).
>
> * a set of "last sent" message number pointers, one for each topic, which indicate the high water mark of what was sent to the remote site during the last update.

At the system level, a list of conferences which have distributed connections.

b) Processes

The following functions must be added to the conferencing system code:

> * Moderator functions to set up and manage the distributed sitename list.
>
> * Distribution Agent which, when called:
> -for each conference in system list, assembles and sends mail message updates to the MTA to be forwarded to the remote system identified in that conference's connected site list
> -processes and parses incoming mail messages received, verifies permissions, adds messages to local conference, then returns acknowledgement to originating DA
> -when acknowledgement of previously sent update is received, updates "last seen" pointers

- A clock driven function to call the DA as specified

c) Message Transfer Agent

If not already available (example: the Bitnet/Netnorth mailer code provided by Columbia University), a message transfer agent must be able to accept RFC822/X400 mail messages from the distribution agent, decode the address information, and initiate the delivery process by inserting the message into the appropriate transport layer driver. As well, it must accept incoming messages, test for recipient address validity (the distribution agent), and forward the message to the DA.

The MTA can be a very simple function where systems are connected together through dedicated communications paths; more complexity arises where selection of paths and connection procedures depends on destination address.

CONCLUSIONS

The architecture proposed above can be an important step in establishing prototype distributed conferencing systems, and testing the implications and dynamics of tying large numbers of users, through multiple local conferencing systems, together.

The architecture proposed is straightforward enough so that projects can be undertaken to add the protocols and processes to existing conferencing systems, and use existing electronic mail delivery vehicles as the inter-system communication method.

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A Toolkit for Designing Communications into Multi-user Programs

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ABSTRACT

Programs which consist of a set of processes running concurrently on different nodes of a network must include communication among processes. This paper describes a toolkit of routines which permit the designer of distributed software to define communications in terms of the requirements of the application.

INTRODUCTION

Communication among computers permits the creation of distributed software, programs with many parts executing concurrently on many processors. To realize the potential of this environment, designers must control and exploit the features of open systems. As characterized by Hewitt and Lieberman [83] in their prescription for distributed artificial intelligence, open systems are subject to change and evolution in their configuration: nodes join and leave the network. Further, the relationships among nodes are "at arm's length": no node has direct access to or control of any other. Decision making is decentralized.

Top-down, structured design does not fit distributed software. This hierarchical approach is in conflict with the decentralized operation of a distributed program on an open system. The notion of a subroutine call, and the implied subordination of one routine to another must be replaced with another notion of communication between autonomous routines. Communication must take into account that the intended recipient may be non- existent, unknown, deaf or uncomprehending. An application designer should not be thinking of communications at this level; rather s/he should be considering issues such as those identified by McArthur, Steeb and Cammarata [83]:

-when to REQUEST: should a particular requirement be met by local computation or by a request to another node for assistance?
-when to COOPERATE: how often should a node interrupt its own activities and listen to other nodes?

As an example, consider a simulation in which one node, x, needs to know the colour of another node, y. A subroutine call is like remembering the colour. In contrast, REQUEST communication is like looking for y in order to determine the colour. The possibility exists of course that x can't see y and fails to obtain the information. COOPERATing is like allowing attention to be distracted from some other activity by a visual cue. Thus x, while doing something unrelated to colour, can notice that y's colour has changed.

MODEL

Our aim is to allow programmers to design distributed software by (i) distinguishing the independent components, (ii) specifying the communications among them and (iii) defining the behaviour of each component by standard means but incorporating communication in terms of REQUESTing and COOPERATing as defined above.

The specification of communications is based on the concept that each component module is an independent system whicn has some capacities to encode and transmit data and other capacities to receive and decode data. Where a sending capacity of one module matches a receiving capacity of another then communication is possible.

A channel is defined as a directed graph, a set of paths from nodes possessing a particular sending capacity to nodes possessing a compatible receiving capacity. Many channels may exist concurrently on a given set of nodes.

For example, a three player game with all roles identical is being played by two humans and a computer strategy routine. It consists of four nodes: one a game module (G) which interprets moves and updates the state of fame, one a strategy module (S) which determines moves for the computer player and two instantiations of an interface module (I) through which the humans participate.

Three communication channels are defined, one on which players make moves, a second on which changes in the game state are announced and a third on which the human players may discuss strategy. The send and receive capacities and channels are summarized in the figure.

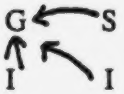
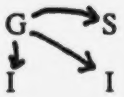
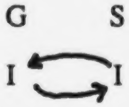
Sending Node	Channel	Receiving Node	Graph
Interface	MAKE_MOVE	Game	
Strategist			
Game	GAME_STATE	Interface	
		Strategist	
Interface	DISCUSS	Interface	

FIGURE
Communication For Three Player Game

Implementation of the channels is hidden from the programmer who concentrates on specifying their behaviour. If the transfer of information is regarded as an encode-transmit-receive-decode sequence then the programmer is entirely responsible for encoding and decoding, in other words for the meaning of the message. The channels regard each message as an envelope which is transferred unopened.

With the toolkit, the programmer specifies the behaviour of a channel. Aside from identifying participating nodes, and message size, the programmer can, for example, select how messages will flow through the channel. One channel might have an "answering machine" flow in which messages are held in the order sent, and received in the same order. Another channel might have a "recorded message" flow in which a single message is continually available to receivers until it is replaced by a new one.

THE TOOLKIT

The toolkit is written in C on a network of ICON microcomputers running the QNX operating system. The underlying message passing structure, which is logically a star network, is based on

the design by MacLean [85/86].
The toolkit consists of subroutines which the programmer incorporates into the code of the independent modules. The subroutines fall into sets which

(i) create and maintain the network of noted:
JOIN_NET connects a node to the network. If the network does not exist when the join is attempted, it will be created.
LEAVE_NET disconnects a not from the net. The departure of the last member node causes the network to terminate.
POLL_NET returns a list of the nodes currently attached to the network.

(ii) create and maintain individual channels:
DEFINE_CHANNEL generates a channel and specifies its
characteristics. Will messages be echoed back to the sending node? Will messages be queued or overwritten? Will the channel exist when no nodes belong to it?
DELETE_CHANNEL terminates a channel.
JOIN_CHANNEL includes a node in the communication on a particular channel.
LEAVE_CHANNEL withdraws a node from participation in a channel.
POLL_CHANNEL returns a list of the nodes participating in a channel.

(iii) transfer messages:
MESSAGE_SEND initiates the transmission of a message on a particular channel.
MESSAGE_RECEIVE reads a message off a particular channel.
TEST_MESSAGE determines whether a message is waiting to be received on a particular channel.

USING THE TOOLKIT

The programmer must consider how the communication on a channel is regarded by a particular module in terms of REQUESTing and COOPERATing mentioned above. Consider the computer strategy module of the game example.

In a standard design, the strategy would be a subroutine called by the game. It would return a move and stop executing. For a simple game, it might compute and return the optimal move; for a more complex game, it might receive a "time limit" parameter and when time ran out it would return the best move found so far.

In the distributed environment, the strategy module of a complex game can run continuously. After it makes a move, it immediately begins planning the next. As it plans, what role will communications play? Let us suppose it will REQUEST information from the game state update channel to better focus its planning. It must also cooperate by interrupting planning to make a move when required. We presume the state of the game indicates when a move is required.

With toolkit routines and channel names in upper case, the main algorithm of the strategy node is:

```
JOIN_NET(strategynode)

DEFINE_CHANNEL(MAKE_MOVE, no_echo, delete_when_empty, queue)
JOIN_CHANNEL(MAKE_MOVE, strategynode)
MESSAGE_SEND(MAKE_MOVE, participate_request)

JOINCHANNEL(GAME_STATE, strategynode)

repeat until gamestatus implies strategynode is in the game
    MESSAGE_RECEIVE(GAME_State gamestatus)

repeat until gamestatus implies game is finished
    current_best_move := planstep(gamestatus)
    MESSAGE_RECEIVE(GAME_STATE, new_gamestatus)
```

```
        if new_gamestatus <> gamestatus
           gamestatus := new_gamestatus
           if gamestatus implies move_required
           MESSAGE_SEND(MAKE_MOVE, current_best_move)

LEAVE_CHANNEL(MAKE_MOVE)
LEAVE_CHANNEL(GAME_STATUS)

LEAVE_NET
```

The gamestate channel can then be of the "recorded message" type and the move channel can operate like the "answering machine" so player moves are all incorporated by the game module in the sequence sent.

FUTURE DIRECTIONS

We are using the toolkit to develop distributed applications. We expect this will lead to revisions in the toolkit itself but the main aim is to build models of communication. Some of these will be models of 'real world' communication, like sensory input, for use in simulations but others will capture the new power of the distributed environment. There is only a beginning to the exploitation of this potential. Models of communication might help.

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ELECTRONINC MESSAGING -
MESSAGE INTERCHANGE

A Study of Atlantic Canadian User Reactions to Two Inter- University Electronic Networks: *

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ABSTRACT

The Office of Educational Communications of the Association of Atlantic Universities (OEC-AAU) has recently completed a study of academic users' reactions to two Canadian interuniversity computer communications networks in Atlantic Canada. The two networks are Netnorth/Bitnet and CDNnet.

The project is described with particular attention to the final results and recommendations. This review includes a brief description of the research plan, the methodology used to select participants, the data collection methods as well as the findings from the pre-use, online and post-use questionnaires and the computer-monitored data.

Finally, some of the likely future directions for academic research networks is discussed.

Introduction

The present study was undertaken because a number of questions related to the use of large store-and-forward distributed mail networks needed to be addressed in order to plan future inter-institutional network development in Atlantic Canada. Although computermediated communications and consequently, network development is predicted to grow rapidly over the short-term, in Atlantic Canada as well as elsewhere, many user-related factors have yet to be examined.

First, it is uncertain if, how and why average users in post- secondary institutions will want to use large distributed mail networks. Secondly, as more users begin to access networks, their specific needs in terms of training, information, services and features demand to be considered. Thirdly, as the number of nodes and networks are proliferating, more hardware, software and network options are becoming available to institutional computer centres and potential or actual network users. Thus it seems more urgent than ever to have user reactions documented systematically so that their needs can be taken into account in on-going and future network development. These needs could then be translated into desirable network features and services which should be implemented if networks are to answer potential user communication and information needs.

The study took place in Atlantic Canada, in 16 post-secondary institutions, under conditions thought to be typical of the conditions under which network users would work. (appendix 1) In the course of the study, two networks were used, that is the Netnorth/Bitnet network and the CDNnet network.

*This project was completely funded by Canadian Workplace Automation of Research Centre
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The Netnorth gateway at Memorial University's Computer Science Department were chosen as the entry points to the networks.

Over the period January to October 1986, the study sought to answer the following questions:

1. What is the usefulness of distributed electronic mail networks to academic and administrative users in the post secondary institutions of Atlantic Canada?

2. What are the motivating factors and what are the barriers to network use?

3. Will use of networks change the work habits for users in post-secondary institutions?

4. Will use of networks alter the existing patterns of inter- organizational and intra-organizational communications between peers?

5. What will be the cost implications of using networks in the future, on a longer-term, routine basis?

6. Which network and electronic mail features should be recommended for post-secondary sector users in Atlantic Canada?

The research design chosen for this study is based on the framework provided by grounded theory research, which relies on data emerging from multiple sources to obtain answers to broad questions, such as those which are listed above (Miles, Huberman, 1984; Guba, Lincoln, 1981). Two kinds of data were collected: quantitative data that measures the behaviour of users on networks, and qualitative data that assessed user impressions towards using the networks. Computermonitored data were collected daily, with the participants' knowledge, at the two major network nodes on the connect and disconnect time, the network domain and subdomain of messages sent and received, and the number of characters of each message. This was considered to be the minimum data to be collected (Penniman, Dominick, 1980; Rice, Borgman, 1983). Participants impressions were obtained from post-study interviews and three types of questionnaires: pre-study, on-line, and post-study.

A pre-use questionnaire was mailed to each participant at the beginning of March. The questionnaire was designed to obtain the following kinds of nominal and quantitative information: participant characteristics such as socio-demographic data: participant information regarding production, retrieval and dissemination tasks; and participants' computer literacy skills.

A series of eight online questionnaires were sent to all the participants once it was felt that the majority of participants were capable of using the network. It was thought that the online questions would serve a double function of both collecting user perceptions as they used the networks and also providing some encouragement for users who perhaps had little or no mail.

At the beginning of October, after the data collection period had ended, a post-use questionnaire was administered. It addressed similar questions and topics as in the pre-use questionnaire. Of particular interest was the change in user perceptions about the usefulness of distributed networks in their work as well as questions probing changes in the quality and quantity of their work. Open-ended questions allowed users the opportunity to explain what factors they felt discouraged their fuller use of the network, and what changes they would suggest for improving the network access.

Finally, post-use in-person interviews were conducted at the end of October with 31 subjects, with the technical support or "help" contacts at each network node, and with members of the steering committee. The participants were asked to describe their successful use of the network in terms of what they are able to use the network for and with who? Furthermore they were asked if they saw a future for electronic mail in their work. Would they try to stay on a network after the study is over? What changes would they suggest to better enable them to use the network? Finally they were asked to comment generally on any aspect of the study which came to mind.

the 'help' contacts were asked a different set of questions. They were asked about their contacts with participants on the network. The help contacts were asked at the beginning of the study to keep a diary or record of their contacts, the reason for the contacts and whether there were 61 study participants:

At the outset of the study there were 61 study participants: faculty members, and administrators of post-secondary institutions. (appendix 2) Their computer experience ranged from neophyte to relatively experienced. The criteria for their selection was based on the following:

1. be interested in computer networking;

2. be full-time faculty or administrators or a combination;

3. have the necessary hardware and communications software readily available at their place of work;

4. have reason or need to communicate with someone outside of their institution.

One criteria was that each participant should have a group to communication with in other settings or locations. Therefore, participants were elected on the basis of their membership in various associations or groups such as the Canadian Society for the Study of Higher Education (CSSHE), OEC-AAU liaison people, Atlantic Telematics Association (ATA), Canadian Association for Distance Education (CADE), and others. This selection process was based on the assumption that members of a group would have reasons to communicate with each other.

Training:

Once potential participants had been contacted by telephone, met the four selection criteria and verbally agreed to become subjects in the study, they were given an appointment with a trainer for on-site training and a demonstration. Most of the 61 participants were trained between January 17 and February 18, 1986 at eight different locations in Atlantic Canada in a total of thirteen group training sessions. Participants who were unable to attend the training were either dropped from the study or given individual training prior to the beginning of the data collection period. The training concentrated on the commands necessary to enter the network, compose, send, receive messages, and logoff. Editing and searching directories were only briefly explained.

As well, participants were expected to use available and existing computer resources, in their individual departments and institutions, whether the hardware was a mainframe or a desktop microcomputer, and regardless of the modem, or the type of communications or operating software available. This meant that each of the study participants used a unique route and a unique combination of terminal hardware and software packages for communications. (figure 4.6) Only a small number of factors were common to everyone on each network. One of these was the electronic mail software on the mainframe computers hosting the gateway at UNB and at Memorial University. At UNB, all the participants had to access 'Mercut', the e/mail package which permitted access to a 'mailer' for inter-institutional electronic mail using Netnorth. While it is true that there is no uniformity in the mailers used in Netnorth, there was uniformity as far as this study was concerned. At Memorial University the users accessed CNDnet through the EAN software.

Summary and Conclusions:

A basic conceptual understanding of the process was needed, so that the user might be able to sort out terminal or microcomputer functions from modem and Datapac functions, from the functions of a network itself. Without a basic understanding of some of the concepts involved in using the networks, and without some of the skills needed to use the networks successfully, it is unlikely that the number of users will grow substantially. Furthermore, without growth in the number of users and user groups, it is unlikely most users will continue networking as they will not be able to contact their peers on a network.

Two networks were used for the study. By putting some users on one network and others on the other it was possible to make comparisons of user patterns. At the beginning of the study it was very difficult to undertake inter-domain messaging: that is, users on one network found it difficult to reach users on another network. However, as more gateways were introduced, this problem became less important. Therefore the questions related to the technical efficiency of one network over another were not considered. Thus the study concentrated on user reactions. As a result, the study has helped identify those features and services which users need in order to use networks more productively.

The reasons the participants were likely to want to use networks were also judged to be typical. However, as it turns out, not enough attention was given to the selection process. It was thought that peer networking would be an adequate motivation. (as evidenced through membership in an association) It is likely that a more specific reason for communicating is needed, such as a project, an agenda, a research interest, a specific task, or a question to discuss.

The study was conducted over a period of 8 months. Though the volume of network use did not rise in a very marked sense over that period (figures 4.1 to 4.5), the post-study interviews indicated that participants believed that network development would increase dramatically over the short-term. This change is already evident in that there are now ten Atlantic Canada universities connected to Netnorth. As networks were used successfully during the entire study by the researchers and by the study participants as well, their viability is not in question. What the study showed is that certain features and services are required before optimum use can be made of the networks by the average user.

The findings of the study were grouped under headings for use of networks, barriers and motivators to network use, network use and work habits, network use and interaction with peers, use of features, and finally, costs of networks. The results are summarized below.

1. The volume of network use over the study period did not change appreciably, and over time, did not match the participants' expectations.

2. Netnorth users were more active than CDNnet users in terms of the number of messages sent and received but spent less time per participant on the network.

3. Participants were more optimistic about network usefulness, expected time on network and expected frequency of use at the beginning of the study and they were at the end.

4. The most important barriers to increased network use were identified by the participants as the fact that their colleagues are not on a network, and an inability to locate the network addresses of people they wanted to communicate with on the network.

5. Other perceived barriers to network user were due to a lack of time, a lack of an ongoing purpose to communicate, the system was difficult to learn or use and technical difficulties. the last barrier would appear to have been resolved with the availability of technical assistance: online, by telephone, or in person. Neophyte users required more tutorial assistance than experienced users.

6. More experienced users wanted to access services on the networks including directories of news services, electronic directories, and database information.

7. Participants anticipated that their use of the networks would substitute for, or enhance some of their workplace functions but at the end of the study they reported that the use of the networks had not affected their work habits. The only exception was the expected decrease in the number of telephone calls made.

8. The participants needed more information about both how to use the networks and what is

available on networks before they could go on to increased, productive use.

9. It was expected that certain work functions, for example, the co-authoring of papers, would be made easier using networks but this did not materialize during the study period. Primarily the networks were used in place of a telephone call or a letter.

10. Certain basic features were not used by the participants because these features (e.g. online editors) were too cumbersome to learn or to use. There is also the possibility that certain features were not used because they were not known to the participants, due to inadequate information and graining.

11. Technical assistance and expert guidance was needed frequently during the study by those participants who experienced technical difficulties. Such difficulties ranged from file transfer problems to an inability to correctly set the parameters for communicating. Hence, for continued networking, especially in unfamiliar network environments, network providers and designers must provide the technical help which the user is likely to need.

Recommendations:

The successful operation of a network required that a critical mass of users will be reached on inter-institutional networks. In order for a large enough group of users to first, access, and then, continue using networks three sets of conditions are required:

1. assistance to users, including training

2. network and e/m services

3. features

Assistance to users:

1. A pedagogically sound training package needs to be developed. It would incorporate practical objectives, with an accompanying list of required skills. The package would be designed to include the following: (by checklist) and advance to a point in the training which is suited to their needs;

- materials to permit users to self-test (by checklist) and advance to a point in the training which is suited to their needs.

- materials to support hands-on training for inexperienced users

- an abridged list of commands, specific to the users' system, which could be filled in which help of a tutor at the training session.

- instructions for accessing network services, for using directories, for editing and so on, in the form of a short manual.

The package needs to be 'generic' so that it is applicable to the many different hardware and software combinations likely to be encountered. As well, the package needs to be adaptable to specific network access situations. (Specifics can be filled in by users themselves).

2. There should be a telephone online help service available most of the day and evening, if possible, on a 24-hour basis.

3. Users should be able to switch off on-line tutorials as they gain experience in using the network.

4. There should be clear non-technical explanations of the different software and hardware components involved in accessing a distributed network, to help users identify the level of computer

activity as clearly as possible, including the operating system, the communications software, the operations of the messaging software on the network, the methods for text formatting and editing, and the basic functions of the modem and protocols for communications.

5. The network must not be oversold: that is, users need to be told what they can obtain on networks, and what is not possible: for example, it is not possible to undertake computer conferencing on a distributed network, at this time.

Network and E/mail Services:

6. There needs to be clear information regarding how to access and use directories of users. Ideally, directories for all networks should be available to individual network users. The directory should be a comprehensive service designed as a distributed data base which can respond to queries regarding interests, occupation, as well as imply a name. This query based directory system should ideally operate across domain boundaries.

7. More interest groups, associations, committees, and users with similar interests should provide network addresses in their (hardcopy) directories. Individuals should write network addresses on their business cards. Faculty lists should include network addresses. Only by making these addresses known will using the networks for communications become as commonplace as using the telephone.

8. New users should automatically be signed onto a directory, but those who do not wish to be listed could so indicate.

9. Some users will require more than a store-and-forward network can offer. For such users there should be easy access to a services directory which tells them how to access such services. It should be noted that an electronic mail service is built upon a data communications network and is just one of many services offered by a network. Other services such as computer conferencing, bulletin boards, information retrieval databases and news should be handled by appropriately designed user interfaces. These new services should be patterned on an international standard. This will ensure the universality of access to the service by all network subscribers. Within the realm of e/mail, there should be a number of standard services such as query driven distributed directory services, the capability to handle binary data with header information, the ability voice and facsimile data, the ability to handle sensitive data through automatic encryption and decryption, automatic confirmation of message delivery, ability to generate automatic replies, autoforwarding of messages, and a framework in which to organize correspondence (folders, etc.).

User Interface Features:

10. Much more transparent access to networks is needed. The e/mail package called Mercury on the UNB mainframe is typical of older messaging systems and is very cumbersome as a first level of entry for the user. By contrast, mail packages on mini computers are simply to use, and incorporate the desirable features which study participants recommended in their wish lists.

11. Features which users require for most sophisticated use of networks include adequate and easy editing and file-transfer software, and simple directions for using these.

12. In Atlantic Canada the most needy network users may be in locations remote from access to mainframes. More thought must be given to providing them access to the large networks.

13. As well, the local access needs to help the user into the network as quickly and as transparently as possible. To illustrate, nearly transparent access would be achieved, if, as soon as a user logs on, he or she is able to select the command provided on a wallet-size card, or shown on the user's monitor. Whether checking for messages or sending a message, the commands should be short, self-explanatory and uncomplicated. If a difficulty is encountered, the user should be able to access a help facility which sill in the messaging mode.

It is recommended that creating such a transparent network environment should be the responsibility of the computer centre where the user has his/her id.

Future Directions:

Several issues were not specifically looked at during the study or occurred during it. There is a need to develop a general training package, encourage better directories within and between networks, and evaluate the usefulness and costs of e/mail and related valued-added services like conferencing. Furthermore technical work should proceed on developing microcomputer versions of the User Agent. Finally, the notion of workplace productivity improvement for network users still requires further study, especially in light of the users hesitancy to pay for network mail services.

Appendix 1: The Networks

Quarterman and Hoskins (1986) (see also Landwebver, Jennings, Fuchs, 1986) have isolated and categorized five basic types of computer networks; research networks (i.e. ARPAnet), company networks (e.g. IBM's VNET), cooperative networks (e.g. Bitnet, UUCP), Metanetworks (e.g. CSNET) and common carrier networks (e.g. Datapac). A distributed network is a cooperative network administered by the community of its users. Some centralized control and organization may be provided, such as in the case of Netnorth/Bitnet. In other networks, less organization, user support and control is provided as is the case with CDNnet at this time. The Netnorth/Bitnet and the CDNnet networks are but two examples of networks which link post-secondary and research institutions in North America.

Netnorth/Bitnet

The Netnorth/Bitnet network uses leased dedicated data communication linkages, essentially transparent to the user, to permit electronic communication, file transfer and access to a variety of services perhaps unavailable on the mainframe of the "home" university. Netnorth is the Canadian version of this network, and, at the time of writing, some 91 Canadian host computers are linked to 844 Bitnet host computers in the U.S. and 363 EARN host computers in Europe. For Canada, a gateway at the University of Guelph connects Netnorth to Bitnet.

This network provides a store and forward service for message switching across a number of points (nodes). Between each of the points, a dedicated leased telephone line is usually used. At each point the message is checked and transmitted onwards unless the destination happens to be at the switching point itself. Thus, in the case of Atlantic Canada, a message could originate at the University of Prince Edward Island and be destined for the University of Waterloo. The message would consist of a header (address label) and some text (the body if the message). It would proceed from the UPEI computer to the University of New Brunswick computer, where the address would be 'read'. Possibly the message could be stored in a local memory for later forwarding. From UNB it would go onto the Ontario gateway at the University of Guelph where again it may be temporarily stored or queued until its header information is 'read' and with a batch of other messages forwarded onto Waterloo.

CDNnet

CDNnet is a functioning X.400 network which links 65 host computers at institutions across Canada. The X.400 standard will, when fully implemented, permit messages to be sent through any computer or operating system to any other in the form of text, graphics, or code. The standard was adopted by the Comite Consulatif international de telegraphique et telephonique (CCITT) at the new standard for distributed messaging systems in October 1984.

In Canada, the X.400 software (called EAN by its designers) was developed by the Distributed Systems Research Group at the University of British Columbia (UBC) with major funding from the Natural Science and Engineering Research Council. Following this, UBC established a CDNnet headquarters which was to foster the development of a national Canadian network. Shortly afterward this development the Sydney Development Corporation purchased the rights to sell the EAN software to commercial interests under the name of Messenger 400. The CDNnet headquarters retained the right to sell and distribute the EAN software to colleges, universities and non-profit research institutions.

For the purpose of this study, a CDNnet node implemented at Memorial University of Newfoundland served as the gateway to other CDNnet nodes across Canada. At first it was hoped to also use the EAN software in context of another environment, but this was not possible. As with the Netnorth/Bitnet network, it was possible to communicate with other EAN sites across the world as well as with other networks via gateways.

Appendix 2: Participating Institutions

Institution	CDNnet	Netnorth
Acadia University	2	2
Univ. Call. of Cape Breton	2	1
Dalhousie Univ.	4	6
Holland Call.	2	
Memorial University	6	4
Mount Saint Vincent Univ.	2	3
Nova Scotia Agriculture Call.	2	2
Nova Scotia Call. of Art & Design	1	
Nova Scotia Teachers' Call.		1
St. Mary's Univ.	1	2
St. Francis Xavier Univ.	1	1
St. Thomas Univ.		1
Technical Univ. of Nova Scotia	2	
Universite de Moncton	3	2
Univ. of New Brunswick		7
Univ. of Prince Edward Island	1	
Total (61)	29	32

Table 1:

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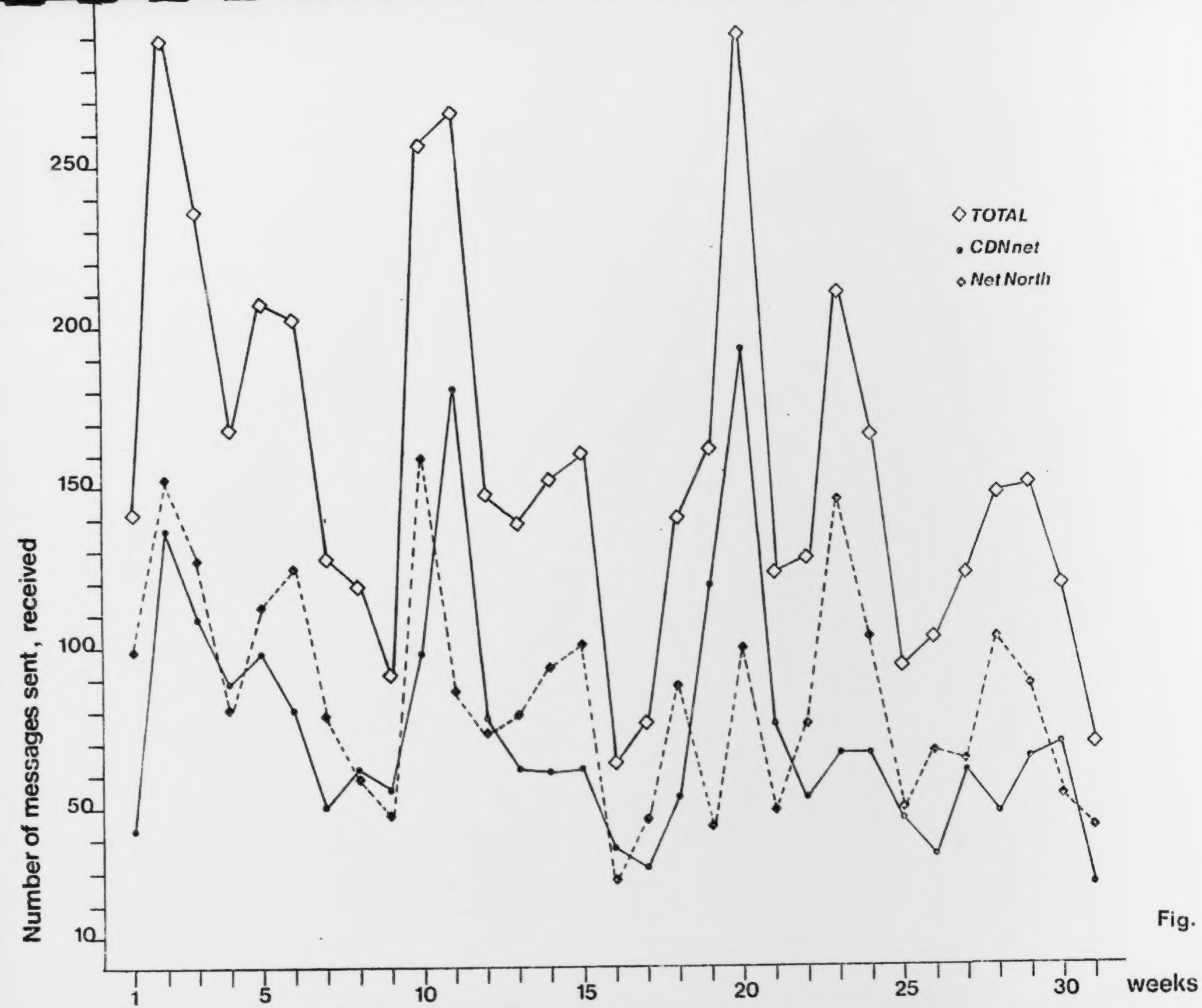

Number of messages sent, received
250
200
150
100
50
10
1
5
10
15
20
25
30
weeks
◇ TOTAL
• CDNnet
⋄ Net North

Fig. 4.1

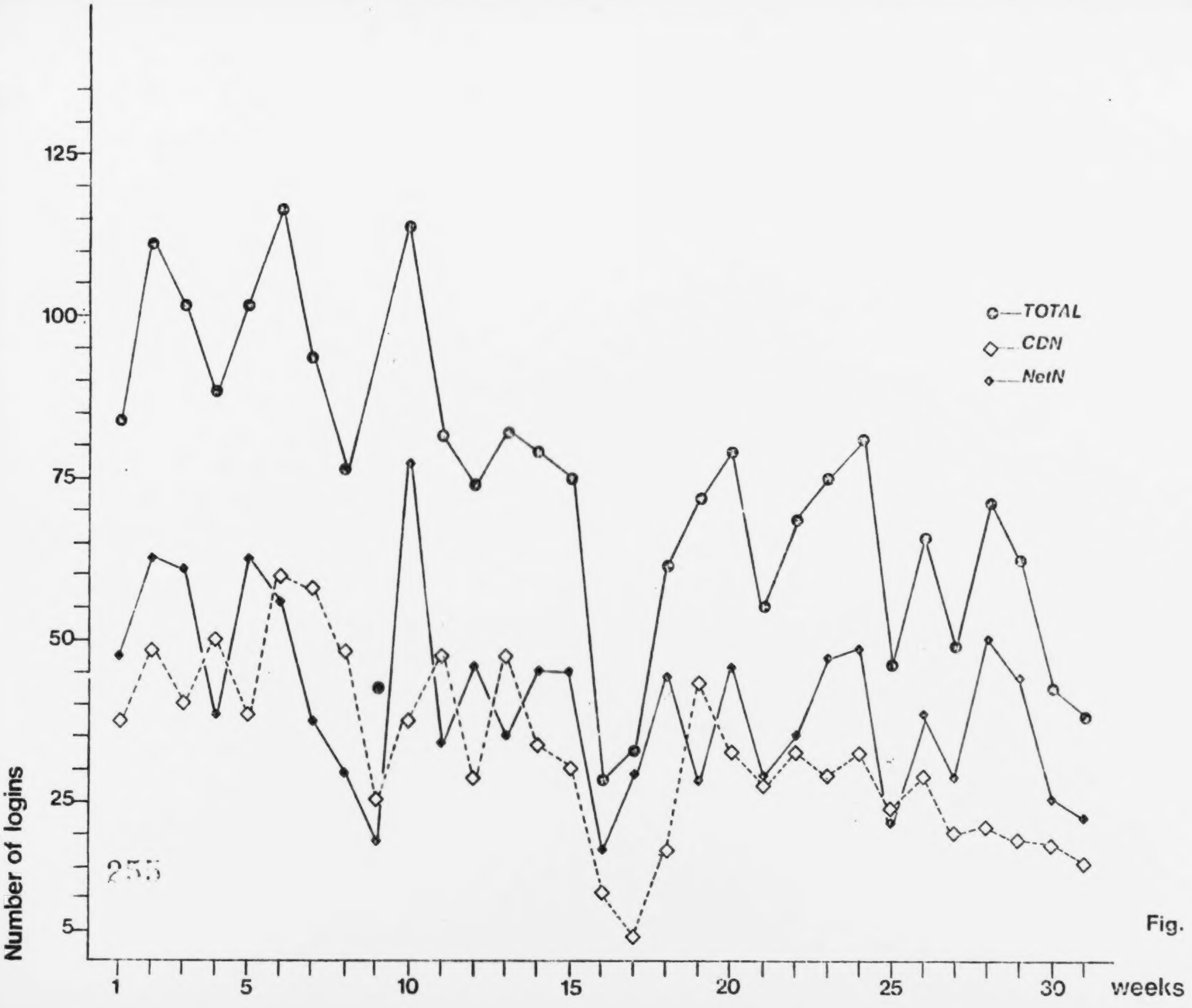
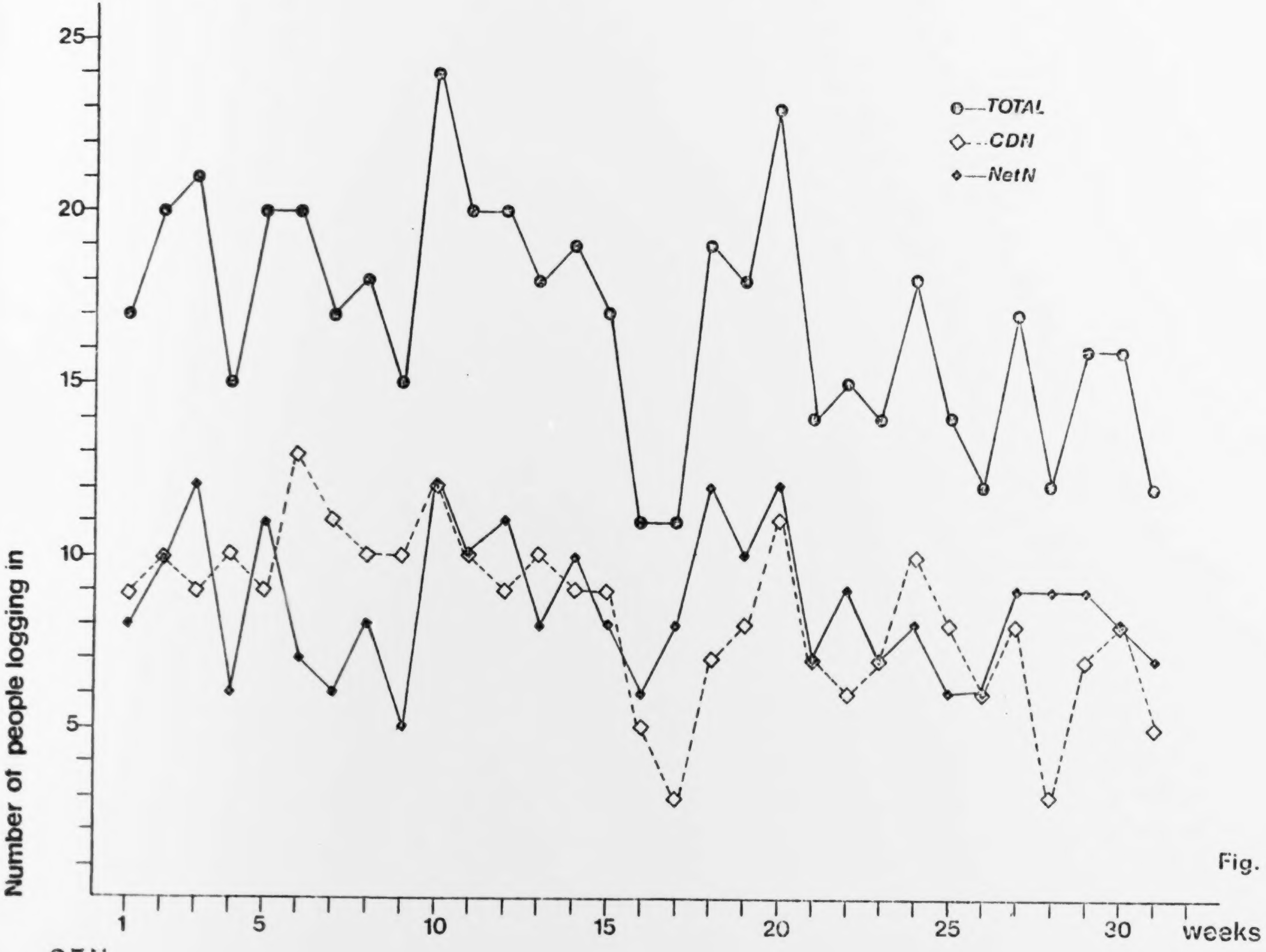

125
100
75
50
25
5
Number of logins
1
5
10
15
20
25
30
weeks
TOTAL
CDN
NetN

Fig. 4.2



TOTAL
CDN
NetN
Number of people logging in
25
20
15
10
5
1
5
10
15
20
25
30
weeks

Fig. 4.3

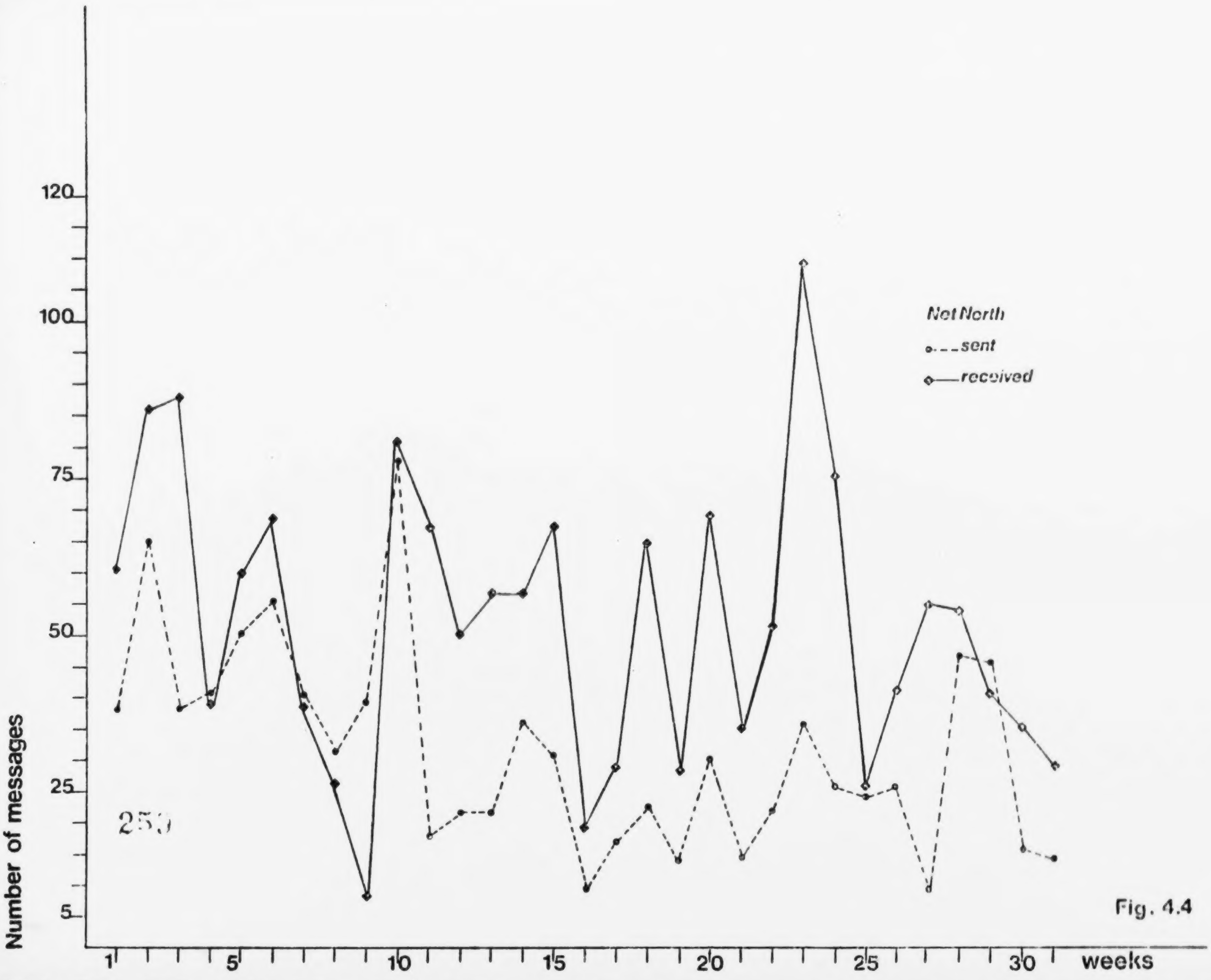

Net North
sent
received
Number of messages
120
100
75
50
25
5
1
5
10
15
20
25
30
weeks

Fig. 4.4

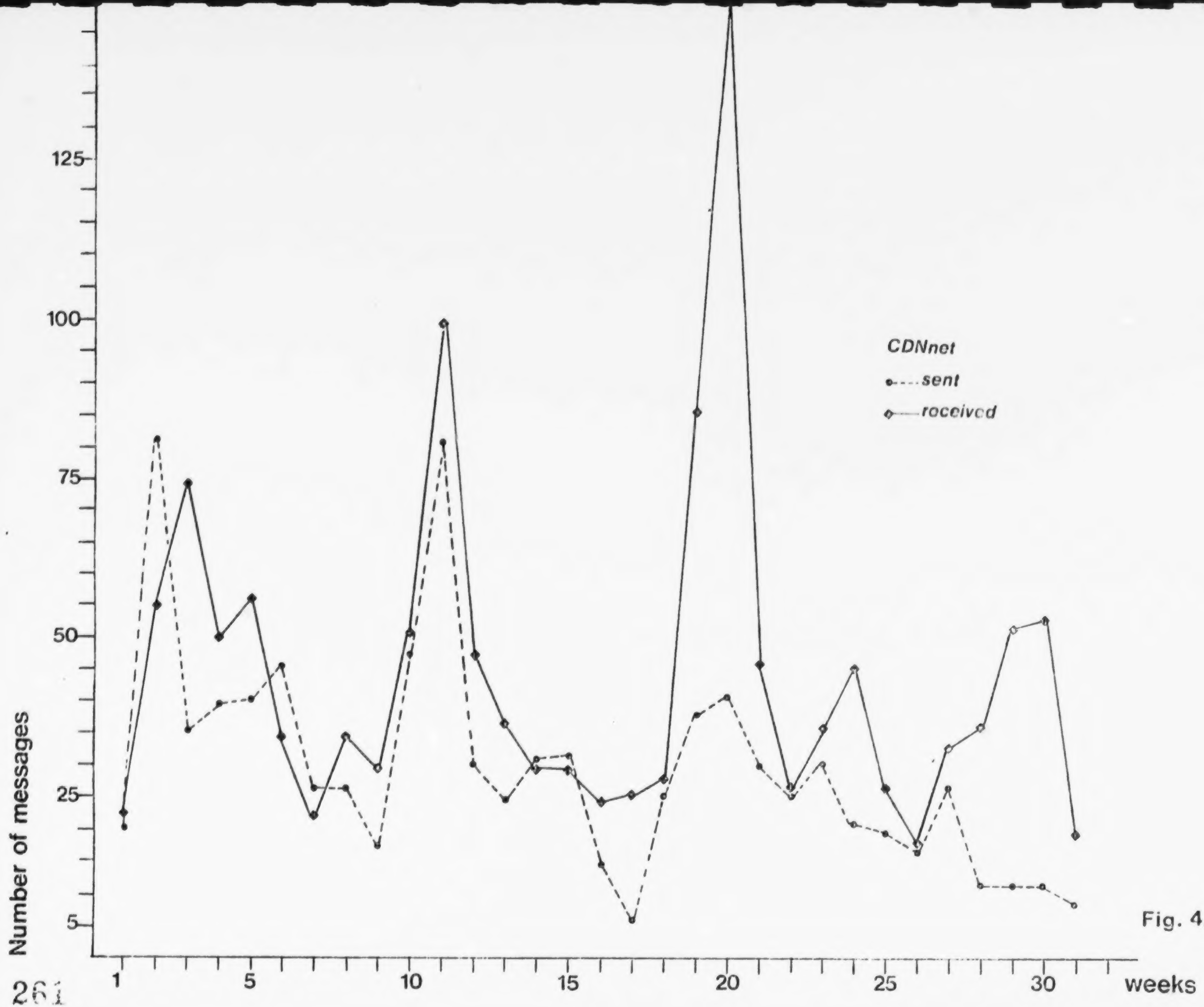

Number of messages
125
100
75
50
25
5
weeks
1
5
10
15
20
25
30
CDNnet
sent
received

Fig. 4.5

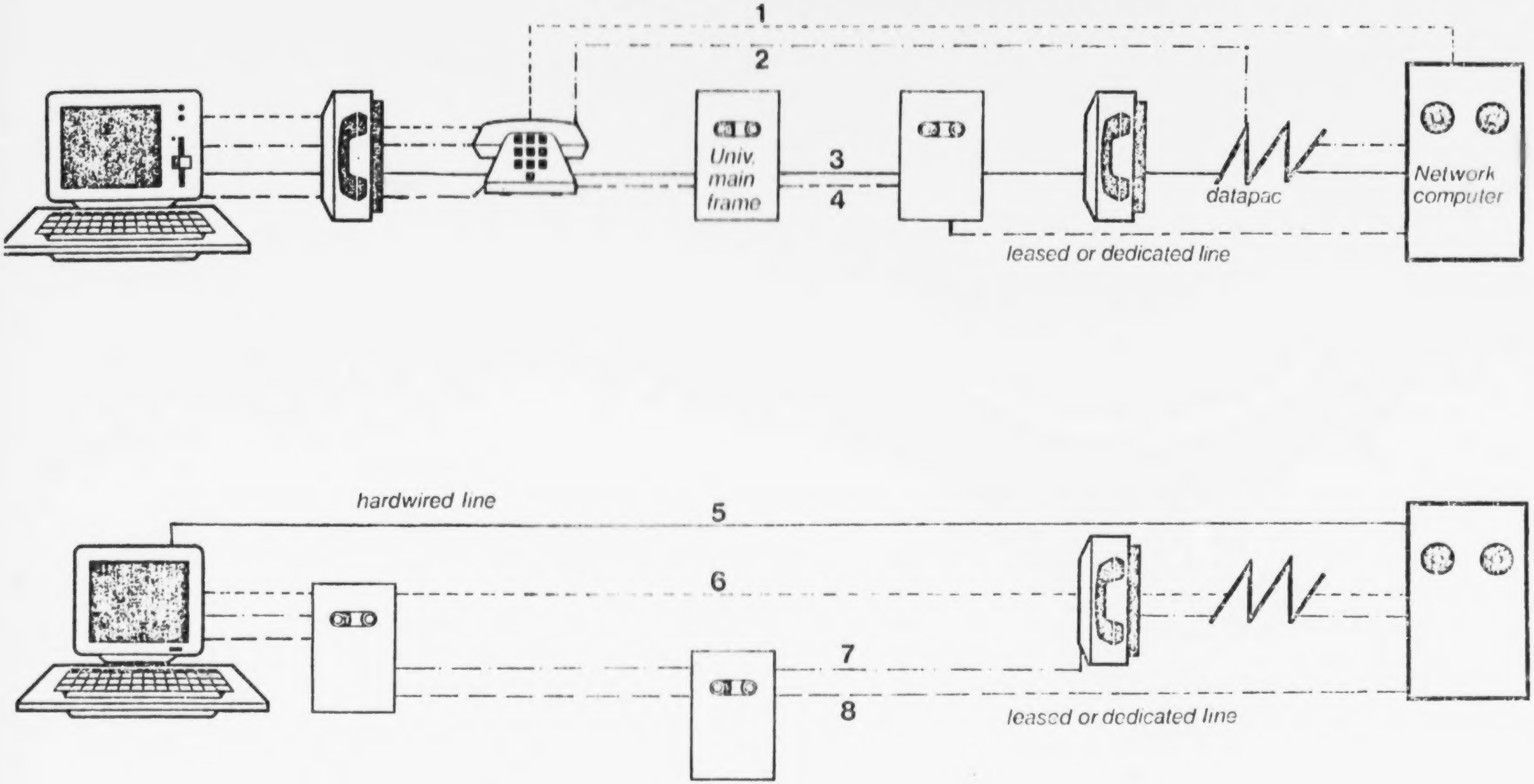

1
2
Univ. main frame
3
4
datapac
Network computer
leased or dedicated line
hardwired line
5
6
7
8
leased or dedicated line

Fig. 4.6 Schematic of Possible Connections to Network

A Low Cost System for Interactive Transmission of Text and Voice in Distance Education

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ABSTRACT

A low cost system for providing interactive transmission of text and voice has been developed for distance education classes. Software packages control specially modified modems, buffer text which has been received, generated for transmission or transferred from data files and provide command menus for instructors and students. Each user can transmit short strings of data and activate data capture at the other stations while temporarily disabling all voice communication. Upon completion of transmission, normal voice communication is automatically resumed. The system operates entirely on Zenith PCs or other compatibles.

INTRODUCTION

The Faculty of Part Time and Continuing Education, at the University of Western Ontario (**PTE**), offers several distance education courses using their own teleconferencing facilities. The courses have been successful but the subjects offered are restricted by the limitation of communications to voice and prepared text. The aim of this project was to improve the quality of these distance education courses, by permitting both instructor and students to communicate by means of simple printed messages as well as by voice and prepared text. An introductory Computer Science course was chosen for the initial study. This paper deals with the technical aspects of a low cost system suitable for lectures and tutorials where moderate amounts of computerized data or text are communicated during a session.

The current method for teaching off-campus students involves the use of verbal telephone conferencing and the predistribution of all necessary course material. When the students and instructor are connected by telephone, the instructor takes charge of the session, but the students have an opportunity to ask questions and receive answers from the instructor. Since only one person may speak at any time, a simple protocol is set up to handle this problem.

In courses such as Mathematics or Computer Science however, it is a very difficult task to give a complete answer to a question by voice alone. The need to support the answer with written text is important and in a class at the university one would use the blackboard or overhead projector to expand the answer. This necessity for spontaneous transfer of written material is even more essential in tutorial sessions (required in many courses) where much time is spent in spontaneous question and answer activity.

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An alternative mode of distance education is computer conferencing where interaction is provided by transfer of text between remote stations and a central computer which provides electronic mail, bulletin board facilities and data bases. The two modes share the common objective of serving off-campus locations, but computer conferencing and voice conferencing have emerged as relatively separate media. While the former emphasizes the time independent aspect which permits asynchronous communication and self-paced learning (Cross (1983), Meeks (1987)), the latter can make use of real-time interactive dialogue, complete with the inflection and emphasis so useful for conveying ideas (Kemp (1987)). Although neither mode provides face to face visual feedback, both provide access to education from remote locations.

In general, there is no convenient and inexpensive way to transfer data between computers using telephone lines which are also being used for voice transmission or where there are more than two computers on a line. Local area networks allow several computers to communicate simultaneously, but these systems are limited to short distances and are expensive. Equipment such as electronic blackboards for transfering written material also exists, but the high cost restricts the number of physical locations that may be used for student centres.

In order to provide a relatively inexpensive way for students to participate in lessons from a number of remote locations, a system has been produced based on the widely used IBM PC and compatibles, specially modified modems and custom software. Criteria that have played an important role in the development of the system, include the need for equipment which is simple to use, that will enrich rather than detract from the student's concentration on the material being presented, and that is of a reasonable price.

BASIC REQUIREMENTS OF THE SYSTEM - PROBLEMS AND SOLUTIONS

To prepare a course such as introductory Computer Science,the following list of requirements was drawn up. Some items were already available, some would have to be reworked for any course and others were as yet non-existant.

Normal voice communication between the instructor and several students (conference call).

Conferencing can be arranged through the public (Bell) telephone system, but problems still arise due to the costs incurred at each session, and the need for an operator who can identify each participent, adjust audio levels on eachline as required and who can reconnect lines which become lost. If several participants are sharing a line at a remote station, additional telephones will be needed. Since the additional equipment can place a load on the line, reducing the signal amplitude, equipment to increase the gain at the remote station is required.

The Faculty of Part Time and Continuing Education has dealt with these problems by providing their own conferencing bridge (DAROME model 2020), a bridge operator and additional remote equipment. Participants use standard telephones, headsets with attached microphones or, when several students are sharing a line, a pedestal microphone and an amplified speaker so all can speak and hear. The participants telephone the bridge operator shortly before the lesson begins. The operator notes their numbers (so they can be reconnected if there are line problems) and puts them on hold while the rest of the class is checked in. Up to 12 callers can be conferenced either all together or in two or three sub-groups.

Control of voice communication by one speaker at a time.

Unlike the classroom situation where sight and sound are available, the only way a person can ask for an opportunity to speak is by speaking. Problems arise when several participants try to speak at once so no one person can control the conversation. The DAROME bridge deals with this problem by permitting only one input at a time (Darome Inc.). The first input to exceed a preset threshold audiolevel for 150 ms takes control and blocks the signals from the other inputs. This control is maintained as long as the audio level is maintained. If the input falls for more than 150 ms, control can be taken up by any other input. In this way, all participants can listen, but only one person at a time is allowed to speak.

Data communication (computer) between the instructor and several students.

Communication between computers over telephone lines is usually accomplished using modems (modulator/demodulator). Data signals on the serial output of one computer are converted from an RS232 level (+/-12V) to a modulated signal which is carried by the telephone lines to the other computer where it is demodulated back to RS232 levels. Modulation is in the form of frequency shift keying (FSK) for low baud rates or phase shift keying (PSK) at higher rates. To contain costs we chose the former (Tandy DCM-3 300 baud modem based on a TMS99532A modem chip).

A full description of modem conventions is available elsewhere, (Deasington (1982), Gengle(1984), Tandy Corporation (1984)). Briefly, separate frequencies are required to send the high and low RS232 levels. By convention, one modem is placed in originate mode transmitting at 1070 and 1270 Hz while the other is in answer mode transmitting at 2025 and 2225 Hz. In this way the signals from each modem are easily identified and received by the other, so simultaneous (full duplex) two-way communication can be established.

When more than two computers are to be interconnected, problems arise. To avoid interference when several modems transmit at the same time, a separate carrier frequency would be required for each modem. This would also necessitate detection circuitry for each of these frequencies in all modems. A communication system of this complexity was beyond the resources of this project but a solution to the problem arose from consideration of the next requirement -- limitation of transmission to a single source at any time.

Limitations of data communications to a single source.

In a two station system where transmission occurs in both directions but only one can transmit at a time (half duplex) a protocol is required to determine which can be active. This requirement was automated by utilizing the squelch (SQT) control on the modem chip. In addition, for full communication between more than two stations, whenever one modem is transmitting, all others must be set to the opposite mode to detect the signal. This requirement was automated by utilizing the request to send line (RTS - pin4) on the RS323 cable to activate the originate/answer control on the modem chip. The electronic modifications to the modems are shown in figure 1.

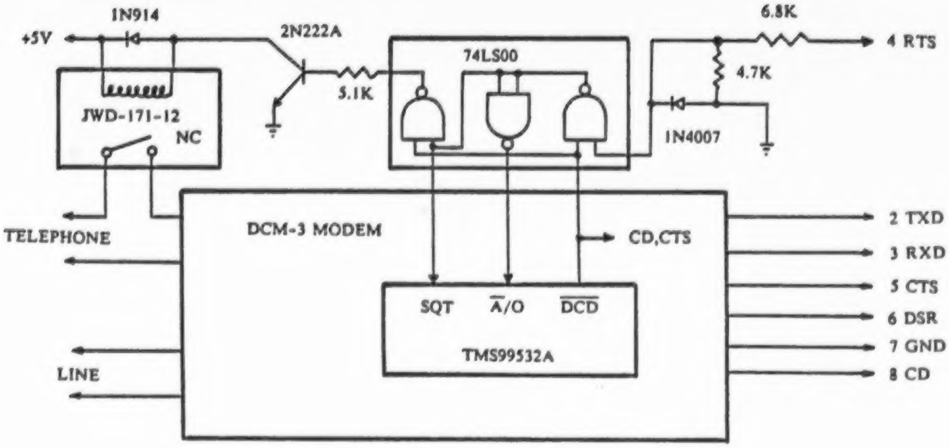

FIGURE 1

Modems were configured to default to answer mode with transmission squelched. In this state all modems are 'listening' for an originate carrier frequency. Upon activation by the RTS line from the serial port, a modem is switched to originate mode and freed from the squelch on the output. This puts a carrier on the telephone line which all other modems can detect. When the carrier is received by the other modems, the carrier detect (DCD) signal is used to maintain them in answer mode, keep them squelched and prevent activation by the RTS line so they will continue to receive data and not interfere with the original source.

Upon completion of transmission, the **RTS** line of the sending modem is set low and the modem reverts to the default settings. Another modem can then take over control if required. This system allows any modem to transmit data while all others receive it, and prevents the interference which would occur from simultaneous transmission by more than one modem.

Separation of voice and data transmission

The sharing of the telephone line by both voice and data presents further problems. Vocal activity at the appropriate pitch can be interpreted as a carrier frequency and result in inhibition of modem transmission and reception of "garbage" data. This would not be a particularly serious problem provided the participants remained silent during transmission. In addition, when several telephones are used at a remote station, the increased load on the line can degrade the signal. A more serious annoyance, however, isthe intolerable audio noise produced by the modem carrier frequency.

These problems are dealt with by using a normally closed **JWD**-171-12 relay on the lines to the telephone. While the modem is unpowered or in the default configuration, normal telephone communication can be established. Upon activation of the **RTS** line (data transmission) or **DCD** line (data reception) the switch is opened to prevent transmission to and from the telephones. In this way the data and voice transmissions are isolated.

Software support

Support is required to control the data/voice switching hardware, to transmit data, to detect and capture transmitted data and to manipulate local data between the keyboard, screen, buffers and disk. Modem communications are usually handled by communication packages (Crosstalk, Kermit, Procall, Chimp etc.) which can use 'smart' modems to dial the telephone, perform initial 'handshaking' routines to establish baud rate and transmit (answer/originate) mode. These programs also monitor the **DCD** line and cease operations if the carrier is lost for more than a brief period of time. These packages are unsuitable for our system since (a) initial communication is established by voice, (b) the system should be constantly ready to receive data although a carrier is normally not present on the line, and (c) routines are needed to activate the **RTS** control line. In addition, the package is required to identify and display text (either keyed in for transmission or received from a remote source), and to handle data files and buffers.

Using this system, data is normally transmitted when one modem is activated. Since spurious signals may occur either when a voice accidently activates the carrier detect or as the carrier signal is initiated or terminated, data strings are preceeded by an identifying header character which is automatically generated but is transparent to the user. Any previous 'characters' are ignored by the receiving computer. If there are problems, the user may verbally request a 'resend' and the sender uses a function key to retransmit the 'last' message which is kept in a buffer for just that purpose. This ease of resending also helps with the problem of spurious characters due to a noisy telephone line. Specific header characters can also be used to restrict transmission to certain locations. For instance, data sent by the students may be received by the instructor alone if required. The data string is always terminated when a carriage return (**CR**) character is received.

In typical use, the sender types the text into a send buffer which is echoed to his screen. Upon entering a return character, the **RTS** line is set high to activate the modem, there is a brief (220 ms) pause to allow the receiving modem to detect the carrier, and then the header character is sent followed by the data string and **CR** character. Transmission occurs only one line at a time so voice communication can be resumed easily. The interruption to voice communication lasts for a maximum of about three seconds for any one data transmission.

After some investigation, it was found that the best language for the software was Assembler. High level languages tended to be too slow, or were unable to access **DOS** functions adequately. **DOS** interrupt routines were themselves often too slow especially for polling the ports. This finding is not new (Dunford (1983)). Therefore much of the software was written to lie beneath **DOS** and **BIOS**, although these routines were used where possible.

In addition to controling the hardware, the software packages addressed some of the educational problems. Courses generally include two types of classes, namely lectures and tutorials. For this reason, two packages were produced, one for each situation.

For the lectures, the student has predistributed copies of the lecture 'overheads', each overhead being a screen full of notes etc. The lecturer has the ability to display the next overhead on his screen and with a verbal command to the students such as "in the next overhead we see ..." the students are cued to display it on their own screens In this case no text data is transmitted across the telephone lines, just the verbal command. During the lecture the student never has need to transmit text to the lecturer so that software is not provided. The lecturer, however, may wish to make a minor modification to the overhead to emphasize or correct something. He can do this on his screen and then transfer the modification to the students' screens. It is assumed that the student, in addition to having the lecture on the screen will also have a hardcopy available (as in a classroom lecture) which can be modified by hand.

In the case of the tutorial, it is important to allow the student to send text to the tutor, either in response to a question or for offering his own examples for clarification. The tutor will also wish to send text to the students. These features are available in the tutorial package. If the tutor wishes to relay information received by him to all students, he can use a single function key to broadcast the message. The most recent message received is buffered for this purpose. Similarly, if data is lost (due to a noisy line) either student or tutor can easily retransmit the information that they have just sent, as the last message typed from the keyboard is also bufferd (separately) for retransmission. The verbal comunication which is always available (except for the brief period while data is being transmitted) warns sender or receiver of what is about to happen.

Since data strings are restricted to a single line of 70 characters, the probability of transmission errors is reduced. This and the low baud rate might appear to be very restrictive, but in a learning situation, it provides pacing. A criticism of most lectures is that the material is covered too quickly.

One must remember that it is a student and not another computer that is trying to absorb the data!

In addition to the send and receive feature in the tutorial package, the whole session is captured on the student's printer so that it can be reviewed at a later date. The voice transmission is not recorded (unless the student sets up a recorder) but the complete set of data both sent and received is printed out with an identifier to indicate what was sent and what was received. To ensure that no data is lost the printer buffer is large (16K) and will continue printing in the background while verbal transmission is taking place. By recording to a printer rather than to a disk, the student is assurred that the data is being captured, and that he will not run out of disk space or overwrite other files. The printout can be referred to at any time during the lesson without interfering with the screen or software package and the student can concentrate on the material being presented rather than on manipulating the system.

Student courseware

Courseware is material that has to be prepared for any series of lectures. In this case it would be sent to the students ahead of time. Each student will require a handbook that includes details about the content of the course, assignments, and guidelines for handing in material. It must also include a hardcopy manual with details on how to use the computer with diagrams showing how to set it up and instructions for doing such things as turning it on, loading the system and running the appropriate packages. At least one tutorial based on trivial material must be devoted to practising using the equipment. One cannot rely solely on the manufacture's manuals as they often written for those with previous computer knowledge.

Some data files such as lecture notes have to be prepared, stored on floppy disks and sent to the students together with the software packages for the interactive lessons and **DOS**. Any additional large volumes of material, such as data files for assignments can be obtained by the students out of class time from a mainframe computer using a commercial communications package, by mail or by visiting the university.

FUTURE DEVELOPMENTS

The major limitation to the system at present is the lack of graphics capabilities (Hiltz and Turoff (1987)). The low baud rate precludes transmission of full screens of graphics, but these can be predistributed on disk. We are planning to transmit strings of coordinate data for local interpolation to overlay lines on the graphics screens. Appropriate routines will be used to optimize resolution and data volume.

CONCLUSIONS

1. An inexpenive system has been developed to allow voice and modem data transmission to share domestic telephone lines.
2. Automatic switching selects the mode of communication.
3. Multiple remote stations can be connected simultaneously for distance education classes.
4. The system runs entirely on microcomputers with no need for mainframe support.
5. Software packages have been developed to operate the modem switching and transmission, to buffer data and to allow the instructor to control the 'virtual' classroom.

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X.400 as a Common Denominator for Electronic Messaging

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ABSTRACT

The widespread use of a variety of incompatible message formats creates problems in providing a single, simple messaging system. Queen's deals with this diversity by converting to a common form specified by the **CCITT X**.400 series of recommendations. The recommendations are reviewed, and the components of a new messaging system based on them "**QK-MHS/VM**" are described, along with some problems and solutions in converting for **PROFS** and **ARPA RFC 822**.

INTRODUCTION

The use of computer messaging for academic communication has grown rapidly, and is becoming an essential service. Our campus is a member of NetNorth, and thus has connections to **BITNET**, **EARN**, **ARPA** Internet, **UUCP**, and several others, reaching a large fraction of the universities and research institutions in the free world. We now handle about 10,000 exchanges monthly with external sites, and considerably more intramurally.

The mere presence of a connection path does not make communication easy. The variety of messaging systems in use, with incompatibilities in addressing, protocols, and services provided, creates difficulties in providing a single, simple messaging system. Some of the systems with which we must deal are:

- **IBM**'s Professional Office System (**PROFS**) [**IBM**85], a menu-driven office support system running under **VM/SP**, used by a large number of our staff who like the variety of functions it provides such as scheduling and automatic proof reading;
- the **ARPA** Internet **RFC** 822 mail format [Crocker82], popular in a wide community including the **ARPA** Internet itself, the **UUCP** network, and NetNorth/Bitnet/**EARN**;
- Telecom Canada's Envoy 100 public messaging system [Shumada85]; and
- the **CCITT** X.400 recommendations [**CCITT**84], used by the **EAN** system [Neufeld85] in **CDN**net and by Northern Telecom in their Meridian system [Purdy85].

None of these fit easily together, and we are left facing conversions.

One way of handling N different messaging forms would be to create conversion programs between each pair, but this leads to N^2 different conversions. If a common intermediate form can be chosen, only $2N$ conversions are necessary. Several recent public and private messaging services are based on the X.400 recommendations, including Northern Telecom's Meridian system, and Telecom Canada's Envoy/**MHS**, and it appears to be the way of the future. X.400 is sufficiently comprehensive to handle all existing forms, and we have chosen it as a focus for conversion.

X.400 MESSAGE HANDLING SYSTEMS

The **CCITT X.400** series of recommendations [CCITT84] forms a standard for electronic messaging. They describe a conceptual framework for communication, and specify a number of protocols to be used between the various components. The layering techniques of the Open Systems Interconnection Reference Model [Zimmermann80] were applied in defining the components and the protocols comprising a *Message Handling System* (*MHS*); the active components are diagrammed in Figure 1.

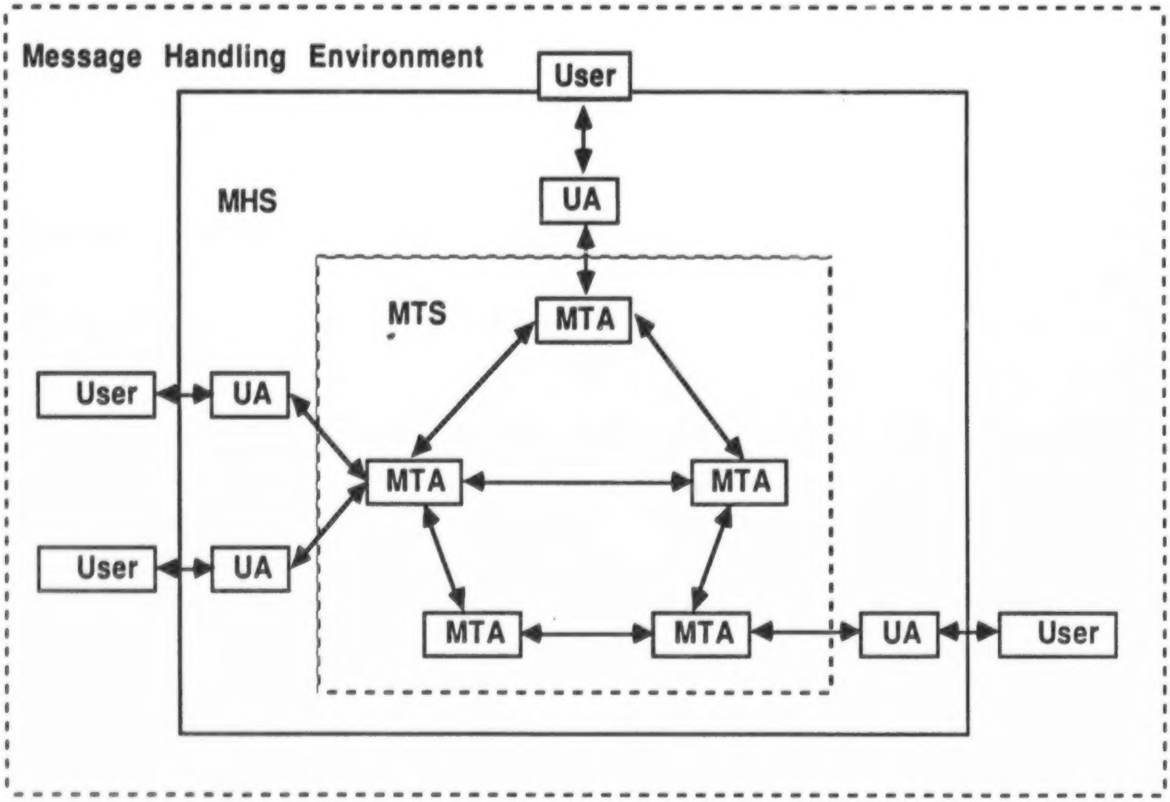

Figure 1. Functional View of the MHS Model (from [CCITT84])

The *users* of a **MHS** can be either people or computer applications. They are referred to as *originators* when sending messages, and as *recipients* when receiving. An originator prepares messages with the assistance of a *User Agent* (*UA*). The **UA** then interacts with a *Message Transfer System* (*MTS*) to submit the messages. The **MTS** delivers the messages to one or more recipient **UAs**.

The **MTS** consists of a number of *Message Transfer Agents* (*MTAs*), which cooperate to relay messages and deliver them to the recipient **UAs**. The messages are then made available to the recipients.

Originating and receiving **UAs** are identified by*Originator/Recipient (O/R) names* , composed of a set of attributes such as surname,organization name, and country. **O/R**-names are intended to locate users based on commonly known, descriptive information, rather than obscure,changeable details such as account codes or terminal addresses.

The basic structure of messages is shown in Figure 2. The *envelope* carries information to be used when transferring the message, and is specified by the **MTS** definition. The content is the unit of information that the originating **UA** wishes delivered to one or more recipient **UAs**, with a format agreed to by the **UAs**.

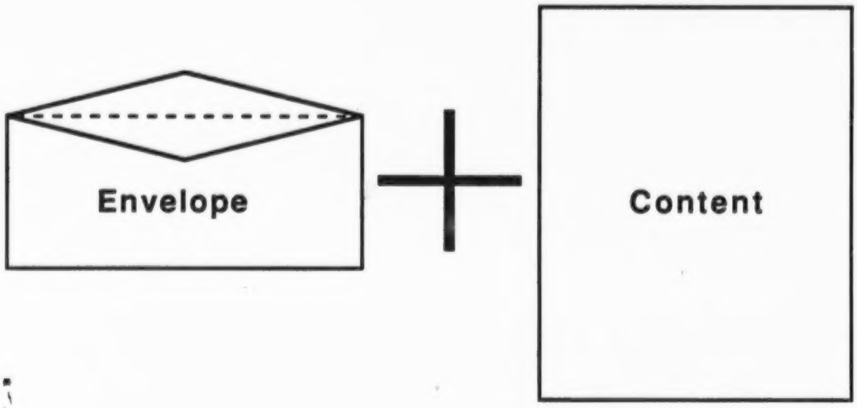
Envelope
Content

Figure 2. Basic Message Structure (from [CCITT84])

The **CCITT** has specified a class of *Interpersonal Messaging* (*IPM*) **UAs** which provide typical electronic mail service. The **IPM UAs** exchange *IP-messages*, modelled on office memoranda, containing a *heading* and one or more *body parts* as shown in Figure 3.

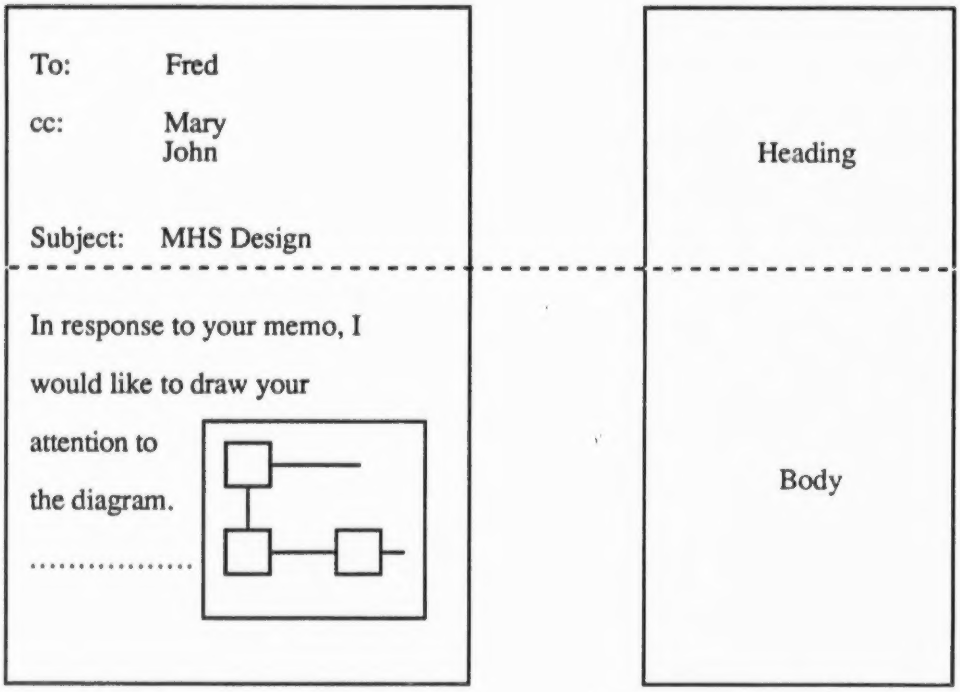
To: Fred
cc: Mary
John
Subject: MHS Design
In response to your memo, I
would like to draw your
attention to
the diagram.
....
Heading
Body

Figure 3. IP-Message Structure (from [CCITT84])

The body parts may be of assorted types, such as **ASCII** text, digitized voice, or facsimile images.

Message Handling System Protocols

Following the **OSI** layering guidelines, the **CCITT** specified three separate protocols for the **IPM** service, shown in Figure 4.

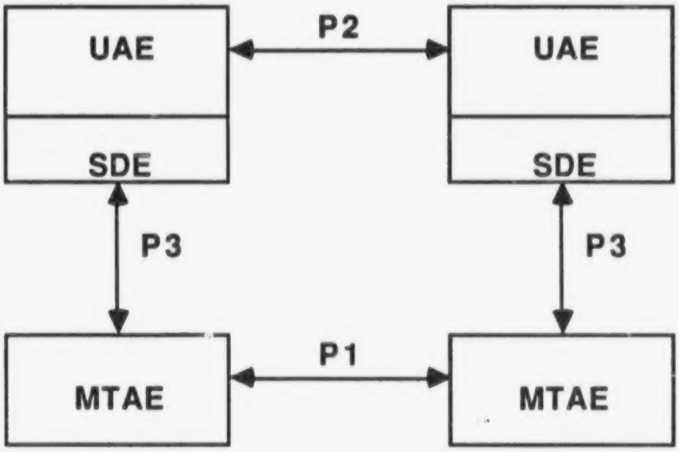

Figure 4. Layers and Protocols for Interpersonal Messaging (from [CCITT84])

The *Interpersonal Messaging Protocol (P2)* operates between User Agent entities; it specifies the format for heading and body parts of the message contents. The *Submission and Delivery Protocol (P3)* is used between the User Agent and the Message Transfer Service; it specifies the interactions for sending and receiving messages. Finally, the *Message Transfer Protocol (P1)* operates between Message Transfer Agents for relaying messages. Below the Message Transfer Service, other **OSI** layer protocols are used to transfer the message units between **MTAs**.

QK-MHS/VM

QK-MHS/VM is our implementation of the **X**.400 recommendations under **IBM's** Virtual Machine/System Product (**VM/SP**) operating system. Its components, shown in Figure 5, are:

- a Message Transfer Agent (**MTA**) running in a service machine;
- an Interpersonal Messaging User Agent (**IPMUA**) running in each user's virtual machine;
- a *Gateway* program, providing mail conversions;
- a *Transport* program for transferring messages between **MTAs** on NetNorth and Bitnet in the form of spool files; and

- an *X.25 Transport* program using Open SystemsInterconnection (OSI) protocols over X.25 virtual circuits.

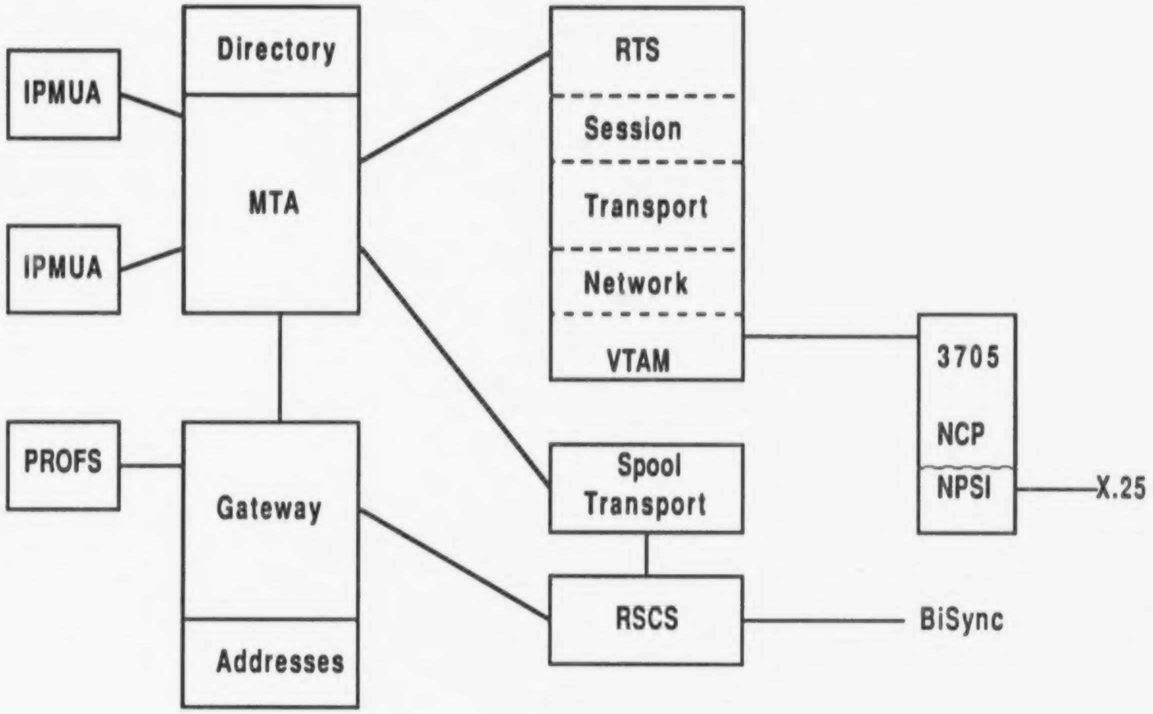
Directory
IPMUA
MTA
IPMUA
PROFS
Gateway
Addresses
RTS
Session
Transport
Network
VTAM
3705
NCP
NPSI
X.25
Spool Transport
RSCS
BiSync

Figure 5. QK-MHS Components

The **MTA**, **UA**, and Transport programs provide a complete mail service using **OSI** protocols, and will be able to connect directly to other X.400 systems as they become available. On the other hand, the gateway allows mail exchanges with existing systems in a reasonably transparent fashion.

An early version of **QK-MHS/VM** was demonstrated by the **IBM** European Networking Centre (Heidelberg) at the Hannover Ce**BIT**'86, communicating with **X**.400 systems of several other manufacturers [Kornel86]. It is now in use at Queen's University, and is being tested at several other sites.

GATEWAY

In converting between **X**.400 and other messaging formats, the Gateway program operates as a combined User Agent and Message Transfer Agent. The functions and restrictions of the different systems limit the transparency that can be achieved in addressing, protocols, and services.

Messaging service elements have been clearly described in the X.400 recommendations, in an abstract way without reference to protocol details. This practice is in keeping with the OSI model, but has not generally been done with older standards. The service elements do however provide reference points for identifying protocol elements subject to conversion. Cases in which no direct correspondence exists can be handled in textual form in the body of the message, avoiding total loss of information.

RFC 822

RFC 822 is a flexible format, and a reasonably complete,reversible mapping between it and X.400 has been defined by S. Kille and others in **RFC** 987 [Kille86]. X.400 service elements are identified with **RFC** 822 heading fields as much as possible, with some new fields defined where necessary. Fields not represented in X.400 are handled by encapsulating them in a separate body part.

Mapping O/R-names with **RFC** 822 addresses follows the same principle. In the ideal case, there is a good correspondence between O/R-name attributes and address components. For example, the attributes

Country=CA
Organization=Queens
Surname=Smith
Given name=David

might be mapped onto the address

David.Smith@Queens.NetNorth

Other cases are handled by embedding attributes in the local part of an **RFC** 822 address, such as

/PN=David.Smith/O=Queens/C=CA/@X400GATE

or an address in a domain defined attribute, e.g.,

Country=CA
PrivateDomain=RFC822
"RFC-822"="mhs_implementation@wisc-rsch.arpa"

PROFS

The messaging component of **PROFS** uses a primitive, proprietary message format, and it is bound up with other features which we are unable to modify. Hence, there are some awkward aspects to the X.400 conversion, which seem impossible to avoid.

The largest problem is addressing, because **PROFS** is limited to a pair of eight character names called "userid" and "nodeid". To map an X.400 O/R-name onto this restricted space, the Gateway uses generates a surrogate userid and nodeid, and records them along with the original attributes in a file. For example, given the attributes

Country=CA
Organization=Queens
Surname=Smith
Given name=David

the Gateway may generate a surrogate nodeid/userid of

$QNS$$$$(SMT00000)

which could then be used to address a **PROFS** note. A **PROFS** "exit" routine will recognize the surrogate and pass the note to the gateway, which will then restore the O/R-name attributes.

In the opposite direction, **PROFS** users are recorded in the **MTA** directory so they can be specified as X.400 recipients using personal names, not userids.

PROFS and RFC 822

Once the **PROFS/X**.400 and **RFC** 822/X.400 conversions are available, a **PROFS/RFC** 822 conversion can be done in three stages. **PROFS** notes are passed to the Gateway, which converts them to X.400 and hands them to the Message Transfer Agent. The **MTA** recognizes the RFC 822 address and notifies the Gateway. Finally, the Gateway accepts the message and converts it to **RFC** 822 form. An address registration program is available to request the Gateway to create a surrogate nodeid/userid for an **RFC** 822 address.

FUTURE

Revisions to the **X**.400 recommendations will be made by **CCITT** in 1988. One goal is to converge with similar standards developed by the **ISO MOTIS** group, particularly in the area of group communications. These revisions should make **X**.400 more suitable for the communication required in distributed computer conferencing systems.

Work is underway within **CCITT** and **ISO** to standardize directory services [**ISO/ CCITT**86]. Once finalized, these standards will be incorporated into QK-MHS. The centralized **MTA** will then be used to distribute and collect mail for independent User Agents on a local area network.

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Ian Cunningham of Bell-Northern Research in Ottawa introduced us to the X.400 recommendations and their implications, which led to the initiation of the **QK-MHS** project.

The **IBM** European Networking Centre in Heidelberg organized and ran the **X**.400 demonstration at Hannover CeBIT'86, proving **QK-MHS** in the real world.

IBM Canada loaned hardware and software needed for the development of the **OSI** transport facilities.

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The Installation of MLNET at the University of Regina
URNET

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1 Abstract

The Department of Computer Science at the University of Regina recently installed a networking tool, MLNET, to define a local electronic mail network, URnet (University of Regina Network). MLNET enables mail transfer between many different machines by taking advantage of existing services, principally Kermit. We have established a well connected electronic mail network between VAX/VMS, IBM/CMS, and Unix systems using MLNET and the Unix 4.2 BSD mail utilities.

Within these operating systems there are a variety of different mail programs. The hub machine, a Unix system that runs the MLNET tools and uses the Berkeley mail program, is connected to both an internal and to an external UUCP network. The IBM/CMS machine uses the Columbia Mailer program (as well as "NOTE" and "PROFS") to send mail to both local and remote users on the NETNORTH network and, through remote gateways, to most networks throughout the world. Finally, there are the VAX/VMS systems that use the DECmail, VAXmail, and ALL-In-One mail programs. The two tools that make the bridging of these diverse mail systems a reality are MLNET and the mail tools of 4.2 BSD Unix.

This paper describes our experiences in adapting MLNET to our environment at the University of Regina. We examine the strengths and the weaknesses in the design of these tools and of the resulting network.

2 Introduction

At the University of Regina we have several computers available to faculty, students, and staff. Table 1 outlines the machines available to us.

Table 1

Computers at the University of Regina

Name	CPU	System	Operated by
Regina	DEC VAX/750	Unix 4.2 BSD	Computer Science
Max (UREGINA1)	IBM 4381	VM/CMS	Computer Services
Phenix (UREGINA2)	DEC VAX	Unix 4.2 BSD	Computer Services
Meena (UREGINA3)	DEC VAX/7800	VAX/VMS	Computer Services
Other Unix	DEC PDP 11's	Unix 2.9 BSD	Computer Science
Other VMS	DEC VAX/750	VAX/VMS	Computer Services

These machines are available to their users at terminals (and from some) microcomputers) via a network of three Develcon data switches connected together using T1 links.

The Develcon data switches provide user access and, in general, do not, provide linkage between the machines for purposes of file exchange. Users wishing to exchange files (and especially electronic mail) between the machines have had few choices. See Table 2. Some users have employed Kermit via "call-out lines" to transfer data between the machines.

Table 2

Linkage Between University Computers

Machine A	Machine B	Technique	Date Installed
Regina	Diverse Unix CPUs	UUCP	July 1984
Meena	Other VMS CPUs	DECnet	April 1985
Max	Meena	FlexLink	July 1985

Figure 1 summarizes present and future intermachine mail linkages between University of Regina systems (and linkages to two academic networks).

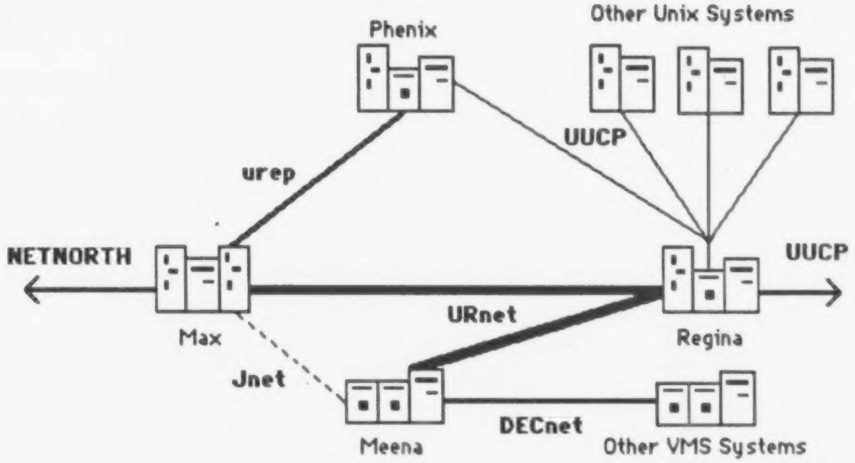

Figure 1: Present and Future Intermachine Mail Linkages

The University of Regina has access to two of the "academic networks," UUCP and NETNORTH. (NETNORTH is the Canadian branch of BITNET [1]. It uses the IBM RSCS protocols.) See Table 3. Phenix has only recently acquired access to NETNORTH (via urep), but has enjoyed a UUCP connection for some time. Meena is expected to acquire NETNORTH access (via Jnet), hopefully, sometime in 1987. Our lack of a uniform, easy to use electronic mail system to link our machines, caused us to turn to MLNET as a possible means of unifying our diverse, incompatible electronic mail systems.

Table 3

Network Mail Linkages at the University of Regina

Network	Machine	Via	Date
UUCP	Regina	Saskatoon	July 1984
UUCP	Diverse Unix CPUs	Regina	July 1984
NETNORTH	Max (UREGINA1)	Edmonton	Oct 1985
NETNORTH	Phenix (UREGINA2)	Max	Dec 1986
NETNORTH	Meena (UREGINA3)	Max	1987 ???

In February 1986, we acquired MLNET from the University of Western Ontario in an attempt to unify our diverse electronic mail systems in a cost-effective fashion.

3 MLNET

There are a great variety of electronic mail systems in use today. They differ in many ways; headers, envelopes, and even in the way in which the body of the message is constructed. Since each mail system is different, they cannot send messages between themselves and therefore are thus isolated from each other. There is a need for tools that allow the diverse mail packages to exchange messages. MLNET is one of these tools.

MLNET was written at the University of Western Ontario [2-5]. It was designed to aid the transfer of electronic mail between different computer systems. Since MLNET is a Unix tool, it was installed at the University of Regina, on the Unix system known as Regina. This machine is a VAX 11/750 running Berkeley 4.2 Unix..

MLNET is able to run on any Unix machine with a Version 7 or newer Unix operating system. There are many mail programs with which MLNET can exchange mail. In fact, any computer system that can execute a set of prerecorded commands can exchange mail with MLNET.

Kermit, a popular file transfer protocol [6-7], is needed by MLNET to transfer files between the host computers. Kermit is discussed in a later section of this paper.

3.1 Installation of MLNET

MLNET was designed to run on a Version 7 Unix machine. Several changes had to be made to MLNET's source code for it to run on our Berkeley 4.2 BSD system. Since the code is easy to understand, there was no major difficulty in converting the program distributed by the University of Western Ontario to our environment.

Since make[1] files are included in the source, it is a simple matter to install the MLNET system. MLNET's original source code is designed for the hardware and software configuration at the University of Western Ontario, thus several changes were required before MLNET could run at the University of Regina. For example, the names of the systems MLNET interconnects are embedded into MLNET's source code. To change them, the distributed source code files had to be edited. All of the places in the code that needed to be changed were easily found. Thus this was not a serious problem. However, a manual describing which parts of which programs to change would have made this job much easier.

Another problem with the installation of MLNET arose because we had a different configuration for our host machine. At the University of Regina, we had more than one disk drive connected to our host machine. This caused problems when files needed to be linked together. Unix did not allow files on different devices to be linked. To solve this problem, the lock files were placed in a different directory than the one in which they were supposed to be in. (Lock files are files that prevent more than one occurrence of critical sections of code from running at the same time.)

3.2 How URnet Works

URnet employs the diverse mail systems used on this campus to transfer mail between the many users. Using a script[2] file, the URnet program mlcico[3] logs onto each of the remote hosts and gathers all the mail that is to be sent via URnet, to the URnet account, i.e., mail that needs to be transferred to another URnet host. Next, these mail messages are transferred from the remote host to Regina, the central host. URnet uses the Kermit [6] protocol to do this. Kermit is discussed more in the next section. Kermit must be available on each of the host computers.

After the mail messages are received on the central machine, they are reformatted into the style that their intended host uses. Each system has a different format for headers. The exchanged mail messages must be converted to conform to these formats. (URnet also logs the number of mail messages that it has transferred and errors that it has noticed while trying to transfer files from one machine to another.) Next, the messages are transferred to the recipient host, again using Kermit.

After the messages have been received by the recipient host, they are passed on to the local mail program that distributes the mail to the recipients.

3.3 Kermit for File Transport

Kermit is a file transfer package, available for many computers, using a common, well-defined protocol. It is used to send and to receive files from one machine to another. Kermit uses packets and a special encoding scheme to accomplish the file transfer.

Built into MLNET is a Kermit protocol, with which MLNET transfers mail from one host system to another. Each of the host machines must have a Kermit program that MLNET is able to communicate with. There are versions of Kermit available for most mainframe computers and even for most microcomputers. (To obtain a copy of Kermit for use on a host machine contact Columbia University.)

Since Kermit is being constantly upgraded, there is no guarantee that the Kermit version available locally is compatible with MLNET. For example, the Kermit[4] version on Meena at the University of Regina, had to be replaced with an older version[5], because the newer Kermit would not work with URnet. MLNET is configured with a simple version of the Kermit protocol that lacks the flexibility of many newer Kermit implementations.

3.4 Mail Utilities

This paper does not present a discussion of each of the mail systems known to us. These mail systems differ greatly and there are too many of them. Instead, we limit our discussion to the systems that are used at the University of Regina.

3.4.1 Unix 4.2 BSD

We use Berkeley 4.2 BSD on a VAX 11/750 machine. We use the sendmail program. Sendmail uses the standard Unix mail program to deliver and to receive mail. Since URnet is designed to work with sendmail and the Unix mail program, there are very few modifications needed to adapt mail to work with URnet. The only file that must be changed is the sendmail configuration file.

Additionally, a set of programs called domain servers must be compiled. These domain servers are included on the URnet distribution tape. After this is done, the mail program is able to interact with URnet.

3.4.2 VM/CMS

We run VM/CMS on our IBM 4381 mainframe. On our IBM system we use the Crosswell Mailer package. All mail for URnet is sent to the URnet account on the IBM machine. To do this we established our own domain, UREGINA, on the IBM machine. This is easily done by adding a line in the RSCS configuration files so that all files or messages with a "UREGINA" domain are spooled to the URnet account.

Exec programs must be placed into the URnet account on the IBM. An exec program is a file containing a series of commands. This allows a user to execute all the commands with a single command, the exec command.

URnet handles the IBM Note format in the same way that the Crosswell mailer does. The configuration file is set up so that all Notes with an address ending with ".UREGINA" are placed in the URnet account reader.

3.4.3 VAX/VMS

We have a VAX 8600 running VMS 4.5. A VAXmail account with the same name as the domain is needed. At the University of Regina, we created a domain called UREGINA, and thus also an account by the same name on the VMS system.

Two COM files used by URnet are included on the MLNET distribution tape. (A COM file in VAX/VMS is a series of executable statements, or commands, that are stored in a file.) This file can be "run," that is all of the statements in the file are executed. This allows one to create a file that runs a series of commands. These commands can be all run sequentially, with one action, by executing the COM file. Also, the script files (on the Unix hub computer) for VAX/VMS are tailored to log into our VAX/VMS system.

4 Installing URnet

Currently, URnet is running on Regina, a Unix system. This VAX is also connected to the UUCP network. URnet connects to the NETNORTH network through our VM/CMS system. Via these two external networks, URnet is able to communicate with a vast array of hosts on many networks in the world. This also gives most of our campus computers access to information available through these networks.

4.1 UUCP

UUCP is a network used by Unix systems. There are many nodes or host sites available on UUCP. URnet uses the sendmail package on Regina to send any mail to any node on UUCP. Since URnet is a Unix tool and is designed to be used by the Unix mail program, all mail for the UUCP network is easily handled. UUCP requires the user to specify the mail path. Sendmail usually takes care of this for the user. If the path is unknown to sendmail, the path must be assigned by the user. All mail that URnet receives is first translated into the form used by UUCP. Therefore, no further complications should arise from the mail package not being compatible with UUCP. Also, because UUCP is a homogeneous network most mail files travel through it without any further translations done to them.

4.2 NETNORTH

NETNORTH is architecturally a fairly restrictive network. Within the network, users cannot specify a path because there is only one path. Also, all mail files must correspond to an exact restrictive format. All mail files destined for the NETNORTH network are translated into this format. This is done by the URnet domain server on the hub Unix computer. The format of NETNORTH mail files are defined by the RFC822 standard.

4.3 DECnet

Another network that should be mentioned is DECnet. This is a closed network for DEC machines. It accommodates many operations performed from one computer directed toward another. Also, using DECnet, mail can be delivered to a user on a remote host. VAXmail and DECmail can utilize DECnet, but not in conjunction with messages from URnet.

Unfortunately, VAXmail and DECnet are closed systems. In other words, there are no true gateways into the system. This causes problems with URnet, because URnet must mimic a true system user and ultimately uses the existing mail program to deliver mail to the final destination. VAXmail and DECmail do not allow for a very sophisticated interactions with other programs.

Also, VAXmail and DECmail message headers are very non-standard. This makes it difficult for URnet to create legitimate VAXmail and DECmail headers. Since the headers created by URnet do not meet the specifications of VAXmail and DECmail, these two mail systems cannot be used to reply to nor forward messages coming from URnet.

5 Evaluating URnet

As of August 1986, URnet was installed and is still in use at the University of Regina. Sadly there are still a few problems with URnet. Some of these problems concern the MLNET program itself, others reflect our particular environment.

5.1 On Our Unix Machines

The Unix side of MLNET, is by far, the simplest to use. Most of the Unix mail features can be used, for example, return addressing, forwarding, etc.

When MLNET is run on our Unix host, the program tends to hang when communicating with a VMS system.

5.2 On Our IBM VM/CMS Machine

The IBM machine was the hardest machine to implement. The header format that the Mailer used was different from any other. The machine was also difficult to convince to let MLNET log on. However these problems are now in the past.

The headers of mail messages from URnet are not sufficiently well formatted. Therefore, messages from URnet cannot be forwarded nor replied to.

5.3 On Our DEC VAX/VMS System

URnet works well, but there are a many restrictions and a loss of capabilities: No All-In-One access. No DECmail access. Only VAXmail access with restrictions; including no forwarding, no answering, no use of aliases, no use of distribution lists, no abilities to employ DECnet, etc..

6 Future Work

Progress in intermachine linkages at the University of Regina seems to be in the direction of bypassing URnet in favor of connecting more machines directly to NETNORTH. More systems work on the mail software of Phenix and the installation of Jnet software on Meena will probably cause URnet's justification for existence to evaporate.

6.1 On Our Unix Machines

In December 1986, Phenix, a Unix system acquired NETNORTH access via a synchronous link to Max (our IBM system) and *urep* software. Additional work on the mailer programs on Phenix can result in a NETNORTH to UUCP gateway for all of our Unix machines.

6.2 On Our IBM VM/CMS Machine

PROFS mail is not currently configured to work with URnet. To do this, URnet must read the PROFS mail into a file and use Kermit to move the file to URnet on the host ,Regina, that subsequently transfers it to its final destination.

The URnet program will probably soon disappear from the University of Regina. Therefore no work is being done on the VM/CMS machine to improve URnet's abilities.

After *Inet* is installed, the IBM will have full access to both the Unix machines via Phenix (UREGINA2) and UUCP, and to the VMS machines via Meena (UREGINA3) and DECnet. At that time, these Unix and VMS machines will have full NETNORTH access.

6.3 On Our DEC VAX/VMS System

DECmail does not currently work with URnet. A COM file must be created that removes mail from DECmail and places it into a file. (This can be done using DECmail's command mode.) Next, this file is transferred to URnet on the host system (Regina) and later distributed to the proper recipient.

All-In-One mail can also be linked to URnet in a similar manner. This requires the creation of another COM file.

DEC's Message Router MRGate software has been recently (December 1986) installed on Meena. Message Router allows the exchange of mail between All-In-One mail, DECmail, and VAXmail systems in addition to allowing mail to be exchanged more expeditiously between VAX systems connected by DECnet.

It seems that dissatisfaction with the performance of FlexLink (linking Max and Meena) has caused Computing Services to investigate the purchase, sometime in 1987, of *Inet* software as a replacement . *Inet* will directly link Meena to Max, and therefore to NETNORTH. Hardware to support *Inet* already is in place.

Inet provides full NETNORTH access for VAX/VMS systems including file transfer, mail exchange between all VAX/VMS systems (All-In-One, DECmail, and VAXmail) and all VM/CMS systems (*Note*, PROFS mail, and *Mail*), and interactive command execution supported by IBM's RSCS protocols.

7 Discussion

MLNET is still a primitive program. Some of MLNET's features need more work. However, for the most part, MLNET does its job. It transfers mail throughout our campus, using a variety of machines and operating systems. It does this without human intervention.

Presently, URnet is only run once an hour. This makes electronic mail sent by URnet comparatively slow. Most users would like to have mail delivered more quickly than the two hour worst case, from our VAX/VMS system to the IBM/CMS machine. The first hour can be spent waiting for mail from the VAX/VMS to get to the Unix system. The second hour can be spent waiting for the Unix system to connect to the VM/CMS system.

Not all of the mail messages are very clean when the system has finally delivered the mail to the intended recipient. The headers in some cases are very hard for the recipient's, mail system to decipher. This could be cleaned up fairly easily with the application of more programming effort.

MLNET came to us with little documentation. Had there been a manual for the setup, operation, and maintenance of MLNET, the work for installing the package and keeping it running would be much easier.

On the other hand, MLNET is not a very complicated package, therefore modifications can be easily done by a moderately skilled Unix programmer. The code is easily to read and is well laid out. There is documentation on how to install the script files. The script files are relatively simple to understand and to create.

The MLNET program itself does not need much in the way of upkeep, except when the computer configuration is changed. MLNET can handle many different computer configurations and many different mail programs. If there happens to be a mail program that does not use one of the standard mail formats, a new domain server must be created. This is easy enough for a programmer to create, using the old ones as examples. The script files can handle most problems that could materialize.

8 Conclusions

Recent developments seem to point toward the demise of URnet on our campus. However URnet has served an important role in providing interim intersystem electronic mail exchange facilities and in providing justification for the need for more robust linkages between our diverse machines.

Overall, we believe that MLNET is a very useful package and that it was well worth the trouble to install.

9 Acknowledgements

The MLNET license was purchased from the University of Western Ontario using funds provided by NSERC (Natural Sciences and Engineering Research Council of Canada), to support Individual Operating Grant, Number A0895, entitled: Development of a Computer Communications Network for Rural Health Care Practitioners,.

10 Footnotes

1 For a description of make files see Unix documentation.

2 A script file is a set of commands that MLNET uses to interact with a specific system.

3 Mlcico is a program designed for use by MLNET and is based on the Unix program UUCICO.

4 Kermit-32, Version 3.1.066

5 Kermit-32, Version 2.8.22

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Linking Electronic Mail Systems: X.400 Standards are the Glue

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ABSTRACT

This paper reviews the CCITT x.400 series of recommendations for message handling systems. Included in this discussion are: how the use of an X.400 network views the system; the CCITT's formal network model; administration of X.400 network domains; services provided by the network; specific protocols defined by the X.400 series; the relationship of X.400 to other communication standards; global acceptance of the series of recommendations; and, work being carried on at the New Jersey Institute of Technology to implement the X.400 standards.

1.0 INTRODUCTION

The recently released CCITT X.400 series of recommendations for Data Communication Networks Message Handling Systems has received a great deal of attention from industry, governments and other organizations interested in electronic messaging.

As the potential of electronic messaging was recognized (in the 1970's), large number of both commercially marketed and proprietary electronic mail systems proliferated. Because of their dissimilarities and the absence of interfacing standards, these systems could not communicate with each other. Since the need to transfer electronic messages of different types and formats among and within countries is critical, an international effort was made to standardize some of the characteristics of message transfer. In 1984, the International Telegraph and Telephone Consultative Committee (CCITT) issued their X.400 series of recommendations for standards for message handling systems.

The specific recommendations that comprise the X.400 series describe:

-a network model: The X.400 model depicts the relationships between users, the network entities that permit users to compose messages and submit them to the network and the entities that relay messages throughout the network.

-basic service elements: The basic services are those functions that the network offers in accepting/delivering messages throughout the network.

-conversion rules: Message composition systems vary in their output in both format and the method of information representation. In X.400, rules are provided for converting from one encoded information type to another.

-a descriptive notation: A notation is defined for describing information that is exchanged between network entities.

-protocols: A series of protocols are presented that address the interactions of various X.400 entities and network configurations.

The remainder of this paper will describe how a user might view an X.400 network, the formal network model as conceived by the CCITT, the relationship between X.400 and other standards, private and public support of the X.400 standards and work being done at the New Jersey Institute of Technology to implement the X.400 series of standards.

2. USER VIEW OF AN X.400 BASED NETWORK

The CCITT X.400 series of standards do not describe the scope of the user interfaces (i.e., how users compose and submit messages to an S.400 network). Typically, users employ their "favorite" document preparation, electronic mail, or computer conferencing system. Consequently, the user interface to an X.400 network could be a text editor (with or without graphics), a facsimile machine or even a voice or video transmitter.

Figure 1 depicts several physical user-interfaces that the X.400 standards consider.

User A has only an I/O device. Therefore, message preparation, submission and delivery functions have to be provided to the user by network entities. An interactive dialogue between User A and its network servicing entity allows User A to send and receive messages. User B has a "stand-alone" workstation or personal computer. In this case, message preparation, submission and delivery functions reside in the user's terminal. User B need not interact with network entities until a complete message is submitted to the network or one is delivered by the network. In the last case, User C has access to a Teletex terminal (i.e., a particular type of I/O device). In this case, message preparation, submission and delivery are accomplished through dialogue with a network entity specifically designated by the X.400 standards for Teletex interfaces.

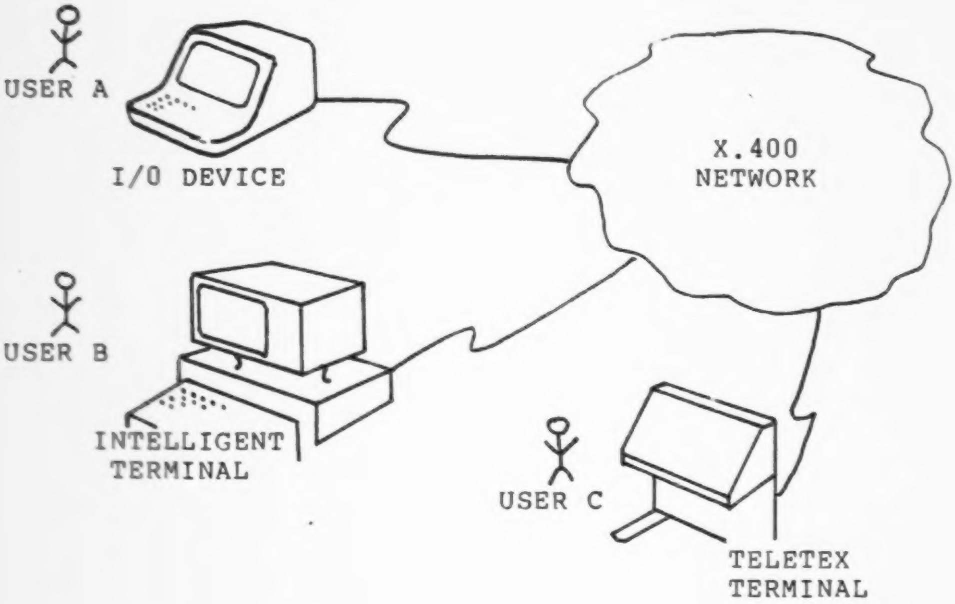


Figure 1. User Physical Interface to X.400 Network

The message preparation facilities available to Users A, B and C might be identical (i.e., functions and invocation primitives are the same). Alternately, they could be totally unrelated in function and form. Users could access the network through electronic mail software, computer conferencing programs, commercial word-processing systems, facsimile copiers or any standardized or customized interface.

All a user (message originator) needs to know is how to compose a message and how identify the recipient(s) of the message. X.400 messages are constructed from an "envelope" and a "content" part. The envelope carries information needed to transfer the message. The content if the information being sent. The user does not have to know how to route the message through the network for delivery to the message's recipient(s).

3. MESSAGE HANDLING VIEW OF X.400 NETWORK

An X.400 network consists of: a class of functional units that allow messages to be submitted/delivered to/from the network; units that cause messaged to be routed through the network to destinations; and, an interconnecting network that provides the links between network entities. Figure 2 depicts this (the CCITT) model of an X.400 network.

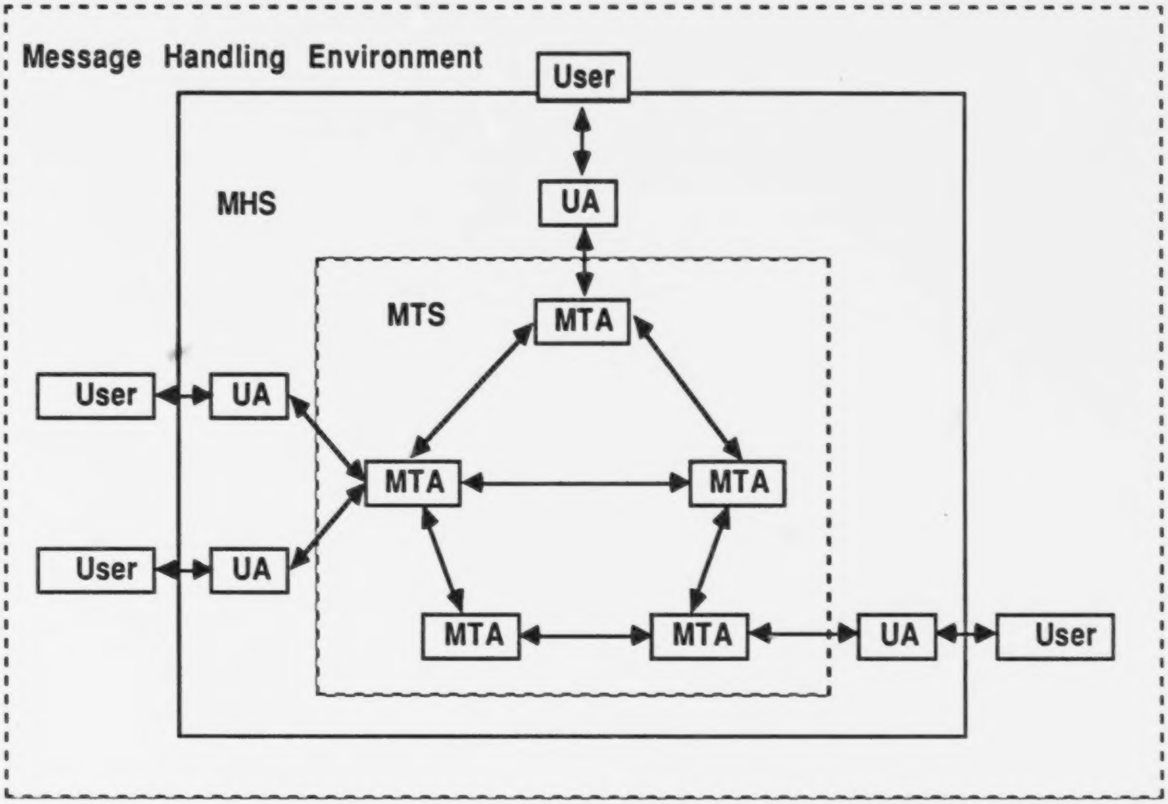


Figure 2. Functional View of Message Handling System Model

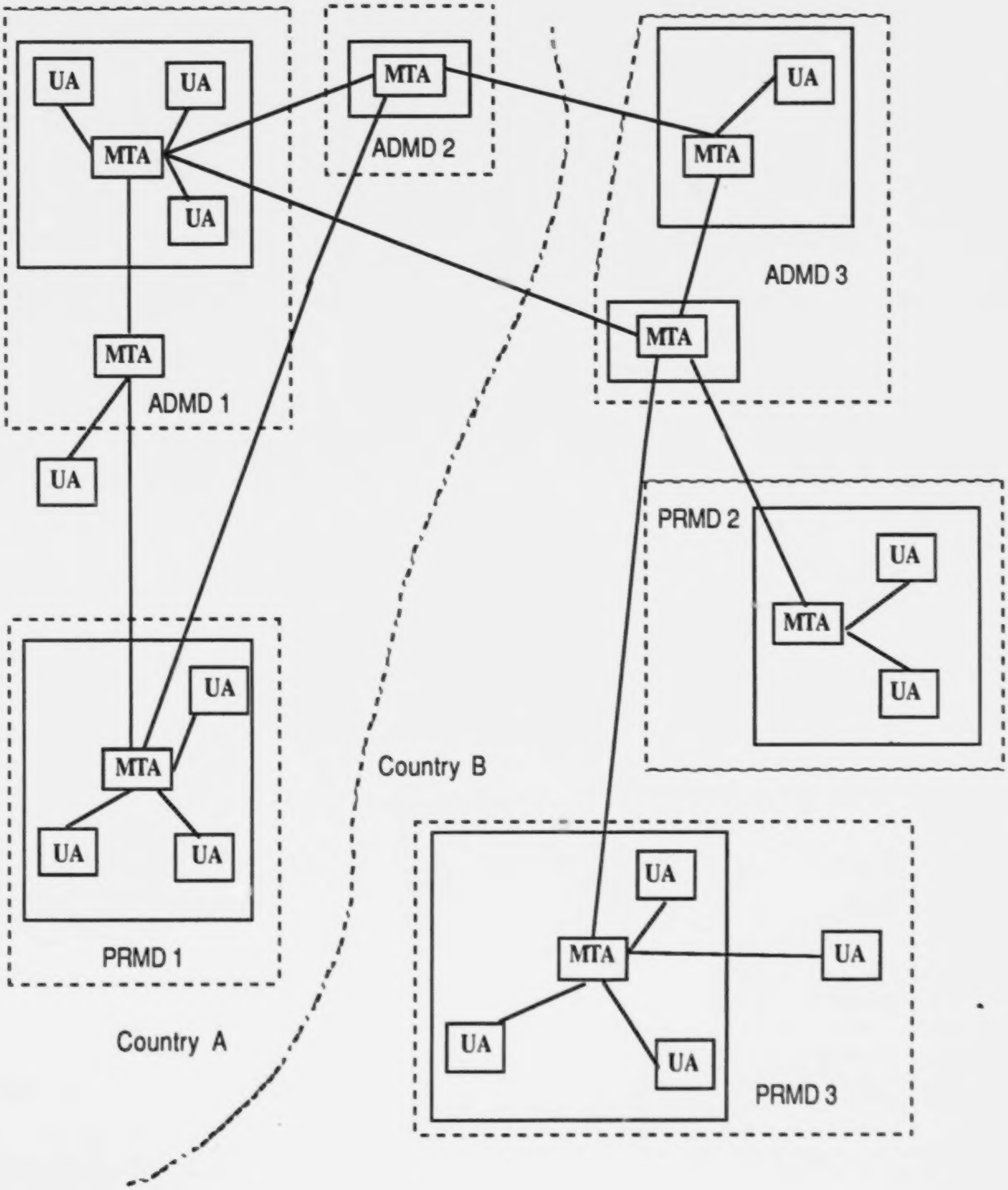
In this model, User Agents (UAs) assist users in the preparation of messages and UAs submit and receive messages to/from the message transfer system. The interface between a user and its UA is not defined in the standard. Consequently, message preparation functions may vary from location to location. UAs transmit messages to Message Transfer Agents (MTAs). MTAs relay messages and deliver them to the recipient UAs. The interfaces (i.e., protocols) between UAs/MTAs and MTAs/MTAs are defined by the X.400 series of standards as are several other network protocols.

The collection of UAs and MTAs is called the Message Handling System (MHS). The collection of MTAs is called the Message Transfer System (MTS).

4. GLOBAL VIEW OF AN X.400 BASED NETWORK

There is another perspective of an X.400 network addressed in the standards, that is a "management" view.

Collections of UAs and MTAs are organized into "domains". Figure 3 depicts this concept of "management-domains".


UA
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MTA
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ADMD 1
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ADMD 2
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ADMD 3
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PRMD 2
UA
MTA
UA
UA
MTA
UA
UA
PRMD 1
Country B
UA
MTA
UA
UA
UA
PRMD 3
Country A

Figure 3. X-400 Management Domains

Domains are managed by either companies or non-commercial organizations. Domains managed by non-commercial organizations (e.g., governments) are called Administrative Management Demands (ADMDs). Domains managed by organizations (e.g., corporations) are called Private Management Domains (PRMDs).

An administrative domain can provide network access to subscribers in several ways. For example (see Figure 4), a user may be supplied with an I/O device that interacts with an ADMD- private stand-alone UA that interacts with an ADMD-MTA.

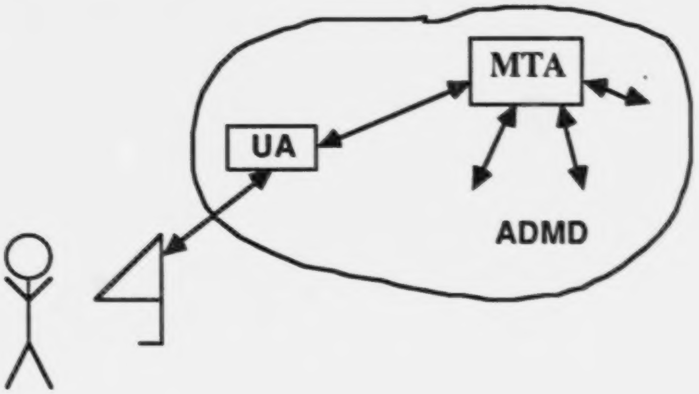

Figure 4. ADMD-Supplied UA

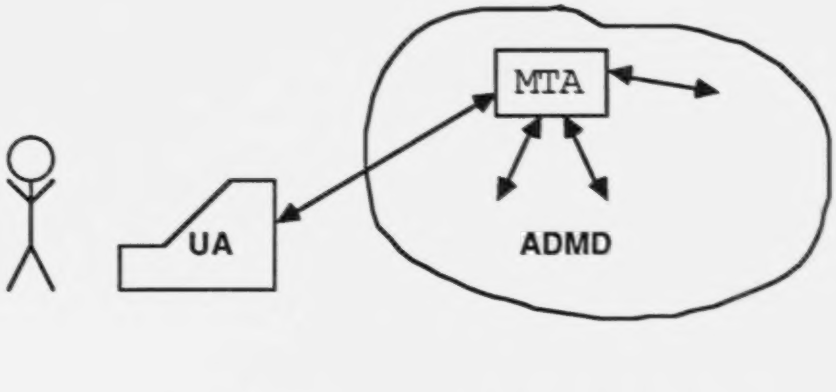

Figure 5. Private UA to ADMD-MTA

Another boundary may be that of a private MTA to an ADMD-MTA as shown in Figure 6.

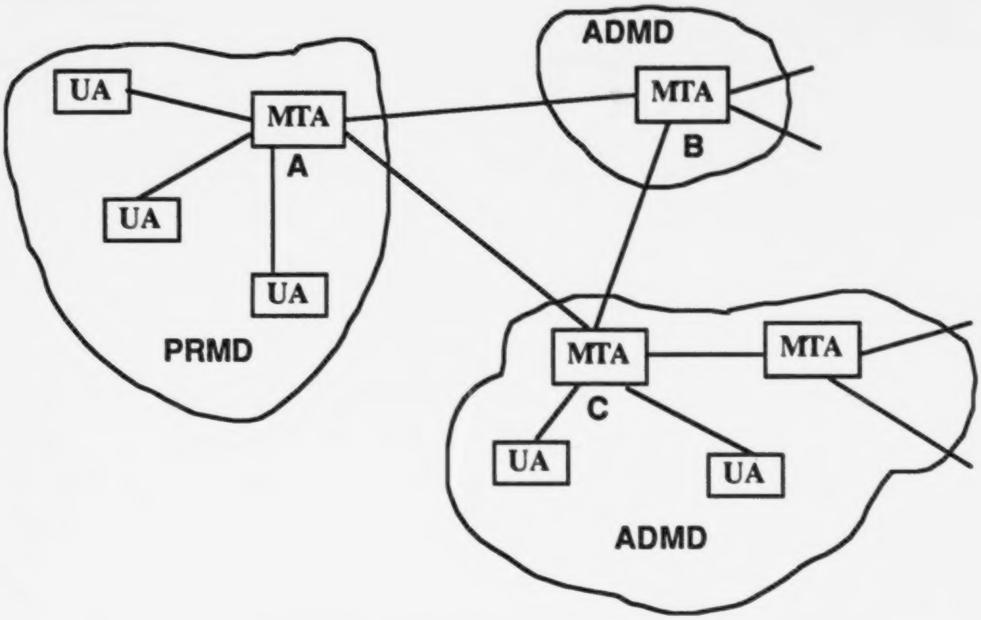

Figure 6. PRMD-MTA to ADMD-MTA

This arrangement permits PRMD-originated messages to be routed to other administrations (either ADMDs or PRMDs). The administrations, however, are prevented from using a PRMD's-MTA for relaying to other ADMDs or PRMDs. In Figure 6, MTA-A cannot be used by MTA-B to relay a message to MTA-C or vice versa. Only ADMD-MTAs are used for relaying.

5. SERVICES PROVIDED BY AN X.400 MHS

In order to exchange messages, there are a collection of services provided by X.400 network entities. These include:

-unique identification of messages submitted to the network (for later referral)

-originator notification when messages are delivered or cannot be delivered

-permissions registration (for example, a UA can inform the MTS of the encoding formats that can be delivered to it)

-specification of encoding type of a message and any constraints on code conversion

-submission and delivery time stamping

-access management (e.g., through passwords)

-grade of service selection (e.g., urgent/non-urgent)

-multi-recipient specification

-alternate recipient designation

-deferring delivery until some later time

-query services (of the availability of a UA to receive messages)

Some of these services are basic in that they are critical in enabling a UA to submit messages and have messages delivered to it. Other of these services are optional in that they can be selected on a per-message basis or for a contracted period of time.

There is an additional class of functions that are specified for the X.400 Interpersonal Messaging Services (IPM). IPM permits UAs to cooperate so that subscribers in a locate community (e.g., within a company) can communicate with each other. These subscribers not only have the basic services described above at their disposal but also UA functions that allow subscribers to provide information about their message's format, its importance, timeliness, etc.

6. X.400 PROTOCOLS

In addition to providing a formal network model, a description of network services and a notation for specifying protocols, the X.400 series of recommendations defines four specific protocols.

6.1 P1 Protocol

The Message Transfer Protocol, P1, is used for communication between Message Transfer Agents (MTAs) (see Figure 7).

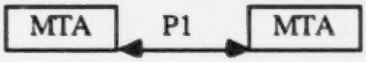

Figure 7. Message Transfer Protocol, P1

The data elements exchanged between MTAs using P1 are called Message Protocol Data Units (MPDUs). MPDUs are classified as either User-MPDUs (UMPDUs) or Service-MPDUs (SMPDUs). UMPDUs carry messages. Service MPDUs carry information about messages. Figure 8 depicts the format of an MPDU.

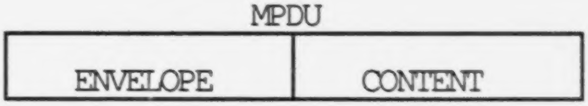

Figure 8. MPDU Format

The envelope contains such information as:

-a unique identifier for the MPDU

-originator's identity

-information about the encoding type used

-priority designator

-deferred delivery indicator

-recipient(s) information (identification)

-network trace information gathered while routing the message through the network

Depending on the kind of MPDU being transferred between MTAs, all or only some of the above envelope information will be present.

If the MPDU is a UMPDU, the content is the message being routed through the network. If the MPDU is a SMPDU, the content may be null (e.g., when the network is being queried) or it may contain information about the delivery/non-delivery of a previously submitted message.

6.2 P2 Protocol

The Interpersonal Messaging Protocol, P2, is used for communication between cooperating-UAs that are providing IPM services (see Figure 8).

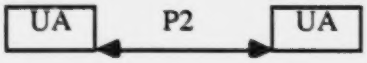

Figure 8. Interpersonal Messaging Protocol, P2

The protocol elements exchanged between IPM-UAs are called User Agent Protocol Data Units (UAPDUs). Like P!, P@ data units can carry messages or status information. A P2 data unit carrying a message is depicted in Figure 9.

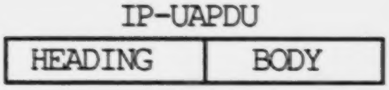

Figure 9. Interpersonal Messaging UAPDU

The heading consists of information about the message. This information is modelled on a memo structure and includes such items as: originator identify, recipient(s) identity, subject, "reply-by", copy recipients, etc. The body contains the message being sent and information about the format of the message. Like P1, a P2 status report UAPDU contains information about messages such as delivery/non-delivery data.

6.3 P3 Protocol

The Submission and Delivery Protocol, P3, is used by UAs that are remote from their MTAs so that the UAs can gain access to the message transfer system (see Figure 10).

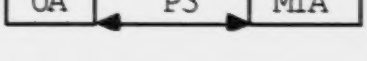

Figure 10. Submission and Delivery Protocol, P3

The Units of exchange between the two entities are Operation Protocol Data Units (OPDUs). OPDUs contain information to allow operations to be invoked or to report the result of a previous operation invocation. Operations are invoked on either the UA side or the MTA side. Typical of the P3 operations are: setting registration parameters, changing passwords, submitting messages, probing the network about the deliverability of a message, delivering a message, notification about the delivery status of a previously submitted message, etc.

Each P3 OPDU specifies the operation, its argument(s), an outcome of the operation (result or error) and information returned with the result.

6.4 P5 Protocol

The Teletex Access Protocol, P5 governs the communication between Teletex terminals and a Teletex Access Unit (TTXAU) that interfaces users of the Teletex to the message handling system (see Figure 11).

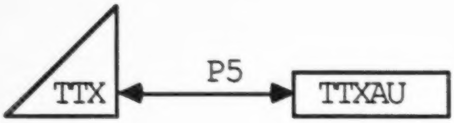
TTX
P5
TTXAU

Figure 11. Teletex Access Protocol, P5

The TTXAU interfaces to the MHS either through the P2 protocol or else the TTXAU is combined directly with an MTA that communicates using the P1 protocol.

The Teletex Access protocol is composed of a series of "actions" initiated by the teletex terminal or by the TTXAU. These actions include: message sending and delivery, network probing for the deliverability of a message, message delivery reporting, document storage request, registration actions, receipt acknowledgement and exception reporting.

7.0 RELATIONSHIP TO OTHER STANDARDS

The CCITT X.400 series of standards reside in the Application Layer of the OSI Layered Model. The following briefly describes the concept of this layered model and the standards assigned to each layer.

In order to isolate already existing standards and to provide a framework for network development nd integration, the International Standards Organization (ISO) developed a formal model called the Open Systems Interconnection (OSI) Reference Model. In this model, networks are described through the isolation of their functions into seven distinct layers as depicted in Figure 12.

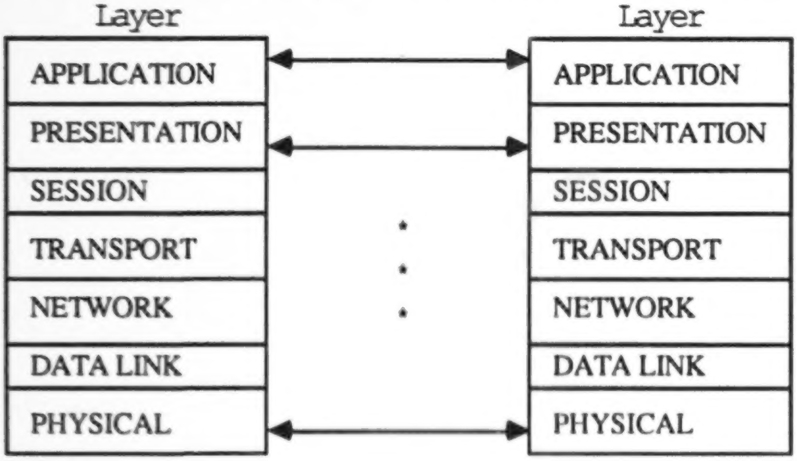
Layer
Layer
APPLICATION
PRESENTATION
SESSION
TRANSPORT
NETWORK
DATA LINK
PHYSICAL
APPLICATION
PRESENTATION
SESSION
TRANSPORT
NETWORK
DATA LINK
PHYSICAL

Figure 12. OSI Reference Model

Each layer is assigned a set of network services. The services residing at a particular layer ar easily described and are distinct from those assigned to the other layers. This philosophy was adopted primarily to keep the interfaces between layers simply, to allow flexibility in changing standards within one layer later in time and for many other reasons having to do with existing standards and future network development.

Layer interactions exist in two directions: peer-to-peer and at layer boundaries. Peer-to-peer interactions are between network entities assigned to the same layer. This is demonstrated in Figure 12 where interactions are shown from Physical Layer to Physical Layer, Application Layer to Application Layer, etc. Layer boundary interactions take place across the interfaces between difference layers, for example, Application Layer to Presentation Layer or Data Link Layer to Physical Layer. So, even though peers (e.g., an Application entity) "feel" they are interacting directly, information is really passed down through the layers on the message originator side an dup through the layers on the receiving side.

Some protocols already exist or are under study for several peer- to-peer interactions and layer boundary interactions. The purpose of each layer of the OSI Reference Model and some existing standards at those layers are as follows:

Physical Layer - This layer incorporated the physical connection (i.e., electrical and mechanical) between the network entities. Some widely used Physical Layer standards are the RS232-C and RS449 standards for physical connectors.

Data Link Layer - This layer builds upon the services provided by the physical Layer. The Data Link layer is responsible for establishing, maintaining and releasing data-link connections and for detecting/correcting errors that may occur in the Physical Layer. The most commonly used standard at the Data Link Layer is the ISO High-Level Data Link Control (HDLC).

Network Layer - This layer builds upon the Data Link services. The Network Layer establishes, maintains and releases network connections and is responsible for routing and relaying. The CCITT has proposed its X.25 standard that describes conventions at the Network, Data Link and Physical Levels.

Transport Layer - This layer builds upon the Network Layer services. The Transport Layer provides reliable transfer of data at minimum cost. Existing protocols that describe functions assigned to the Transport Layer are the CCITT X.214 and X.244 standards.

Session Layer - This layer builds upon the Transport Layer services. The Session Layer provides the means for organizing and synchronizing dialogue between network entities. Existing protocols that describe functions at the Session Layer are the CCITT X.215 and X.225 standards.

Presentation layer - This layer builds upon the Session Layer services. The Presentation Layer is responsible for the representation of information exchanged between network entities.

Application Layer - This layer builds upon the Presentation Layer services. The Application Layer provides the means for application entities to exchange information with other application entities in an open-systems environment. The CCITT X.400 series reviewed in this paper is only one example of Application layer protocols.

8.0 NEW JERSEY INSTITUTE OF TECHNOLOGY AND x.400

Since 1986, members of the Computer & Information Science Department at the New Jersey Institute of Technology have been designing and implementing software to realize major portions of the CCITT X.400 series of recommendations.

This effort is jointly supported by AT&T Corporation, Computer Sciences Corporation and the state of New Jersey Commission on Science and Technology. When completed, this project will result in (see Figure 13):

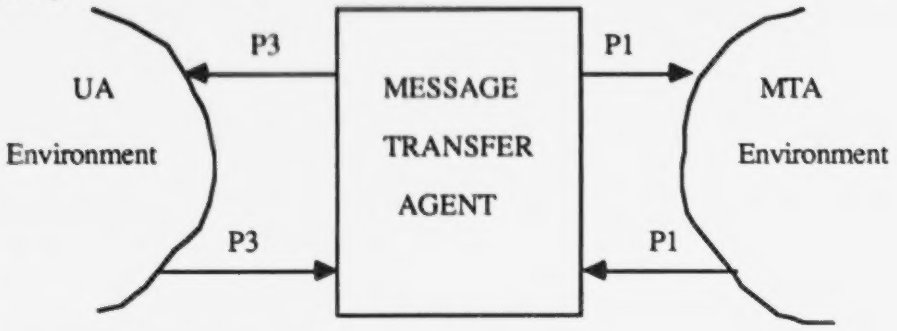

Figure 13. NJIT X.400 Project

a Message Transfer Agent (MTA) capable of:

-accepting the P1 protocol (P1 receiver)

-verifying P1 correctness

-determining the location of message recipients

-relaying a P1 data unit to another MTA (P1 transmitter)

-converting a P1 data until into the P3 protocol when an MTA is responsible for a recipient's UA (P1/P3 transformer) and vice versa

-delivering data units to a UA (P3 transmitter)

-accepting data units from a UA (P3 receiver)

In addition to building the functions directly related to the operation of an MTA, the NJIT project has produced:

-a P1 data generator for test and validation of P1 handlers

-a P3 data generator for test and validation of P3 handlers

-an interactive editor for manipulating test and validation data files

These tools and the X.400 standards implementation are written in the C Programming Language for a UNIX System V operating system environment. Their successful completion will enable providers of electronic mail services to build complex yet reliable X.400 based networks.

9.0 PUBLIC AND PRIVATE SUPPORT OF X.400

Because the X.400 standards were proposed by the CCITT, these standards have achieved international acceptance. Most European countries and manufacturers have publicly endorsed the standards and dictates their adoption within a fixed timeframe.

IN the USA, the National Bureau of standards supports the standards and there is an ongoing effort, sponsored by the NBS, to have implementors agree on X.400 product definitions.

The strongest endorsement of the X.400 standards in the USA comes from the private sector, where over two dozen organizations have collaborated to form a corporation to oversee the "Testing and Validation" of X.400-based products. This organization, called the Corporation for Open Systems (COS), has already let contracts for the specification and implementation of an X.400 test and validation center. The members of COS include Hewlett Packard, Digital Equipment Corporation, AT&T, Wang, Xerox and many other large companies involve din the use and manufacture of electronic mail systems.

10.0 SUMMARY

The purpose of this paper is to provide an introduction to the contents of CCITT's X.400 series of recommendations for message handling systems.

The adoption of the X.400 series of communication standards is well on its way in the area of transmission of text. Future products will integrate voice, text, video and other forms of information representation into electronic mail.

What is most important is that X.400 provides a framework both from the integration of already existing electronic mail systems and for the development of new electronic mail networks.

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A DECnet to NetNorth Mail Bridge

Peter Marshall and Reg Quinton

The University of Western Ontario
Computing and Communication Services

Second Symposium on Computer Conferencing and Allied Technologies
University of Guelph, Guelph, Ontario, Canada
June 1 - 4, 1987

ABSTRACT

This paper describes the development and implementation of a mail system for VMS machines which allows them to participate fully in the RFC822 based mail world. Our network uses a single VAX/VMS system running the JNET software as a gateway for a group of DECnetted systems. This means that only one JNET licence is required to service the entire network.

Each participating computer runs a User Agent (based on Berkeley 4.2 Unix mail) and a Message Transfer Agent (which has many parallels with the Columbia MAILER). These programs operate in the spirit of the X.400 series of recommendations while making use of commonly implemented protocols like BSMTP. A simple mechanism provides a limited interface with Digital's VMS Mail program.

The paper concludes with a discussion of the current status of this project and its future directions.

RESEARCH APPLICATIONS OF COMPUTER CONFERENCING

Information Exchange in the Research Community

An introduction to the Quartet project

Peter Dodd[1], David Pullinger[2], Bill Tuck[3], David Archer[4]

Second Symposium on Computer Conferencing and Allied Technologies
University of Guelph, Guelph, Ontario, Canada
June 1 - 4, 1987

ABSTRACT

Since the termination of the BLEND electronic journal project, the Birmingham and Loughborough teams have been joined by others at University College, London and at Hatfield Polytechnic to work on a more detailed evaluation of the architecture of the information system necessary to support a community of, initially, research workers. This project, which commenced in mid 1986, is in two basic phases - the construction of a modular architecture, and the comparative evaluation of the applicability of the various modules using a number of field studies. The basic architecture will link together electronic mail, computer conferencing, on-line bibliographic data bases and electronic journal system, with data being stored either on a network or on local magnetic and optical media.

The presentation will outline the background analysis leading to the study, will discuss its aims and objectives, and describe the current situation.

1. INTRODUCTION

During the period 1980 to 1984, the Universities of Loughborough and Birmingham collaborated on the BLEND electronic journal project funded by the British Library Research and Development Department (BLRDD). This project set out to explore the use of computer and telecommunication technology as an aid to information exchange within a scientific community, and in particular to develop the concept of an electronic journal Shackel (1982). The progress of the project has been described by Shackel and Pullinger (1984), Shackel, Pullinger, Dodd and Maude (1983) and the software and telecommunications support system by Dodd and Maude (1987) while the experimental findings will be published as further reports.

In brief the project used the Notepad teleconferencing system (Vallee, 1984) to support a range of communication modes from very informal messages to formally refereed articles for publication in an on-line journal. It was relatively straightforward to map the less formal modes onto Notepad as these corresponded to its original purpose, however more discipline was required for the refereed articles, and eventually additional software was provided. The system was used experimentally by a number of communities and was reasonably successful, although its use as an aid to the editorial and referring process was less satisfactory. A probable reason for the latter result might have been the limited nature of the technology available to the participants in the study. For the most part this was

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restricted to that available in the late 1970's, and consisted of dumb terminals connected via the PSTN to a mainframe computer. The period of the BLEND study corresponded to the era of rapid expansion in the use of personal computers and improvements in telecommunication systems, of which BLEND was able only to make restricted use, and this may have contributed to the frustration of the users.

Furthermore BLEND was primarily concerned with the human factors involved in the use of an electronic journal system and, although many improvements were made in the man-machine interface and understanding was gained regarding the use people made of such a system, the framework was too rigid to gain much insight into the necessary components and their economic value. In short BLEND showed that an electronic journal and message system was feasible and delineated some of its parameters but fell short of defining a commercially viable system.

In order to capitalise on the experience gained from BLEND, and at the same time to incorporate developments in telecommunications and optical storage technology, BLRDD asked the present authors to define a further research programme that might produce results more directly relevant to the library publishing interests while retaining its overall benefit for the research community. This request has led directly to the Quartet research project, which commenced during mid 1986.

2. ANALYSIS

In formulating the Quartet research programme we have adopted two complementary approaches:-

a) to build on the strengths and weaknesses of the BLEND programme

b) to describe the present information exchange system and to define an equivalent system based on current and emerging technology,

and these have been used to formulate both the aims and methodology of the project.

2.1 Insights from BLEND

The primary drawback of the BLEND system was its monolithic nature, and its limited capacity for adaption and incorporation of external developments. The former factor meant that it was impossible to attach an independent value to the various features offered by the system, and the disadvantage of the latter is obvious.

However, BLEND did demonstrate that participants in the study made use of the wide variety of facilities offered by the system - mail, conferencing, newsletter and bulletin boards, journals, bibliographic databases and annotated abstracts. While within these categories it emphasised the need for uniformity of image, and flexibility of presentation especially within the electronic journal.

These findings would indicate that any replacement system should be modular rather than monolithic and should incorporate all the facilities provided by BLEND. This modularity would permit a separate appraisal of the value of each facility, and could allow the replacement of modules as new products become available. These new products might arise from developments in the market place or targeted research within the project. A possible dynamic structure for the project is indicated in figure 1. This shows both pure and applied research within the project, and external products feeding into the continuing development of a modular information system. This system is then used by a number of user groups, and this use is monitored in order to provide the assessment of the utility of individual facilities, and also to feedback into the system development path.

2.2 Modelling the Information System

Although there are many actors in the present information system, including authors, editors, referees, publishers, printers, book sellers, reviewers, catalogers, abstractors, bibliographers and readers, we chose, either realistically or chauvinistically depending on your orientation, to consider the information system from the viewpoint of authors and readers. Within the research community at least these are also the same group of people - the producers and consumers of information.

For this group of people, whom we will call scholars, the information exchange system has evolved steadily as the result of an ongoing dialogue between cost and benefit. For example, journals might be thought of as a direct consequence of the difficulties of travelling to the meetings of the specific learned society, and libraries because the costs of storage and production needed to be shared by communities. It is these processes that have given rise to the roles of the other actors in the information system.

The motivation for the BLEND study was the awareness of shifts in the balance of cost and benefit, with the opportunity for electronic storage and communication providing a possible decrease in cost and increase in benefit when compared with the increasing cost of the conventional paper based system. Similarly the widespread introduction of desk-top publishing systems will introduce other shifts, although the cost benefit equation is less easy to foresee. The introduction of this new technology might give rise to changes in the infrastructure of the information system, and the purpose of the Quartet project is to indicate the directions these changes might take. However, our fundamental assumption is that of the stability of the needs of the scholar community.

The scholar can be thought of as a supplier of primary information (research articles), and a consumer of both primary and secondary information. In an information flow sense this person "receives" a selection of information via journal subscriptions, attendance at meetings and by personal correspondence, "searches" for specific information in holdings of journals and other texts using bibliographic material, and "transmits" new information, generally via the postal service, to publishers for further dissemination.

In general the present structure consists of each scholar having access to a personal store of information (his/her own library), and being able to make use of a much larger local store used in conjunction with a number of other scholars (campus or area library). If the information required is in neither of these stores, it can be obtained by request from, usually, a national store, or from some store comparable to the local store (inter-library loan). Additionally the scholar might obtain information by requesting it from a colleague. Less formal information might also be obtained and supplied by this latter route, either via correspondence or travel on visits or to conferences. One of our basic hypotheses, based on findings from the BLEND study, is that there is personal, and group benefit if the ability to carry out these less formal aspects is part of the normal information provision system. To some extent this is provided by the paper- based culture, with both journal subscription and personal mail arriving on the scholars desk. These can in future both arrive on the scholars electronic desk. In pictorial terms the present system can be represented by figure 2.

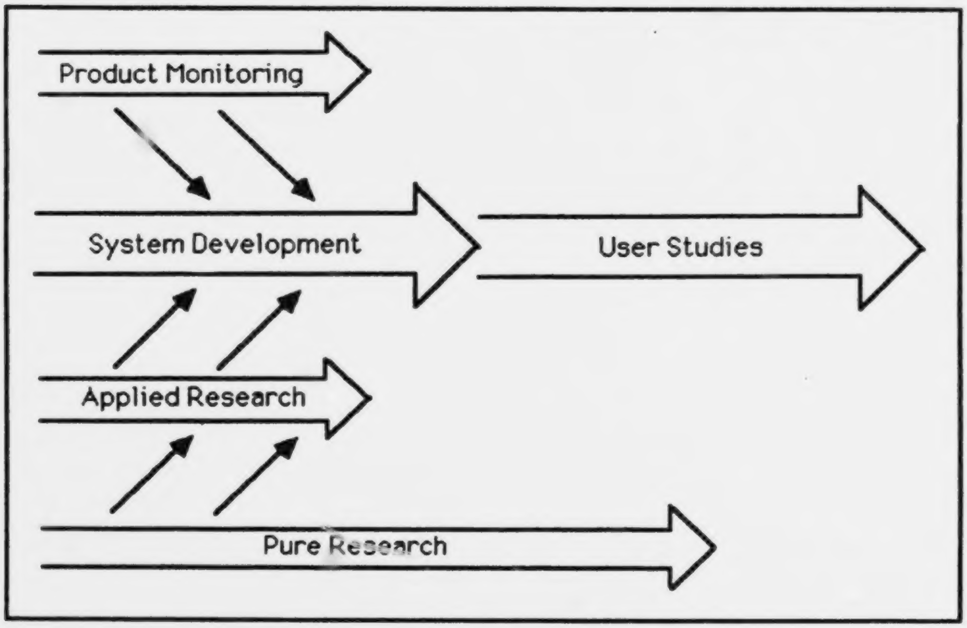
Product Monitoring
System Development
User Studies
Applied Research
Pure Research

Figure 1: A possible time chart for the Project

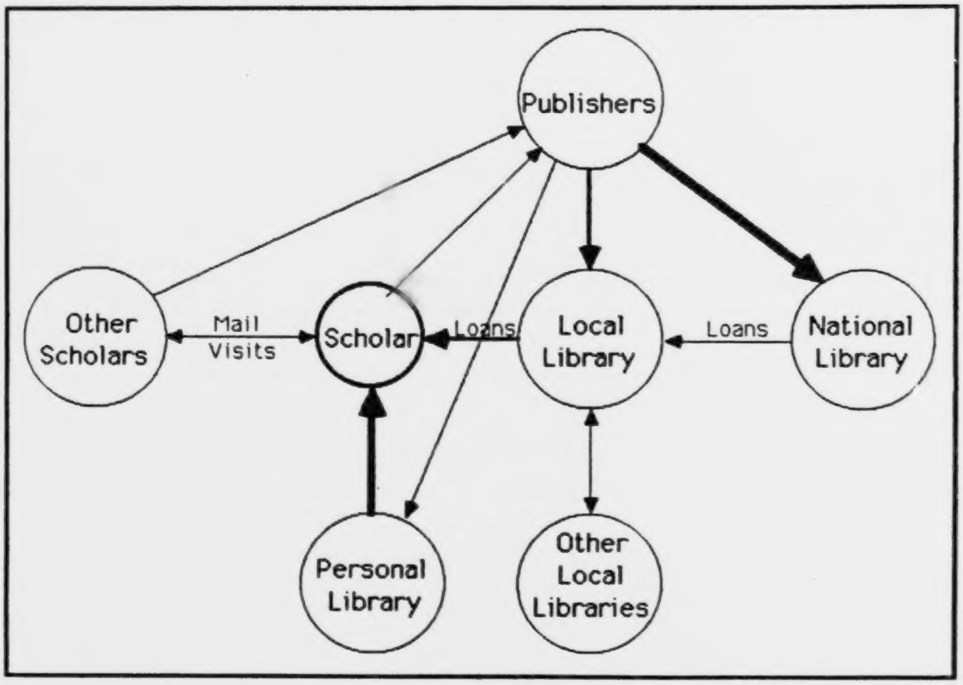
Publishers
Other Scholars
Mail
Visits
Scholar
Loans
Local Library
Loans
National Library
Personal Library
Other Local Libraries

Figure 2: Current Paper-based Information System

An alternative representation might site the scholar at the centre of an information web (figure 3), where the radial distance is some indication of the cost/effort/delay in obtaining information. In an information system based on computer and telecommunications technology, this web could be replaced by Figure 4, and the question arises of whether all these components are now necessary. For example, if high bandwidth telecommunications channels were readily available for access to an electronic library, would it be necessary to have a hierarchical structure for libraries.

There is obviously a large number of alternative ways of restructuring the information system, however we have selected four "limiting case" scenarios which can all be derived from the present structure (figure 2) by selective emphasis on certain of the components. These are:-

a) a network of scholars
b) a centralised system
c) a hierarchical system
d) a distributed system

2.2.1 Scenario 1: Network of Scholars

For this scenario everything is reduced to the essentials and those actors who do not make a direct contribution to the end use of the information removed (Fig. 5). This reduction leaves only the scholars and their individual stores of information and is essentially a return to the picture of the learned noblemen of the renaissance in whose own library there resided all known knowledge. The only external contact of this scholar was via messages to other scholars, and so in the proposed network of scholars it is assumed that they can communicate with each other via an electronic mail system.

The information store for each scholar could consist of two components; a read/write store in which new information and messages could be generated (akin to a standard workstation), and a read only store which could reside on digitally encoded optical discs (e.g. CD-ROM), and there is assumed to be an external mechanism whereby this store is updated. This external mechanism could be loosely entitled "publishing" and would be in contact with all scholars in the network. In practice the publishing facility could be mapped onto one or more scholars who happened to be able to generate CD-ROM's from their read/write store.

2.2.2 Scenario 2: Centralised System

The previous scenario assumed that all the information was stored at the scholar's workstation, giving the advantage of high access bandwidth but creating much duplication and being weak on group communication. In all the three following scenarios, it is proposed that the scholar has only a read/write store for personal use and that all the remaining information is stored elsewhere in the system. This is not to exclude CD-ROM devices from being directly connected to the user's workstation, but as mentioned earlier only limiting cases are presented here.

In this scenario (Fig. 6) all the information is stored in one centralised (national) archive and this national service can also provide mail and conferencing facilities; such a structure would be akin to the BLEND system. It would have the advantages that conferencing is logically easier with a centralised system, there would be no duplication of information and this would only be delivered when required (the average number of readers per article is known to be small), but would suffer from access problems and would either require a very large number of high bandwidth lines or be a non-interactive service. It would also be an inefficient system is a large number of scholars in the same location (e.g. a class of students) were required to access the same information at approximately the same time.

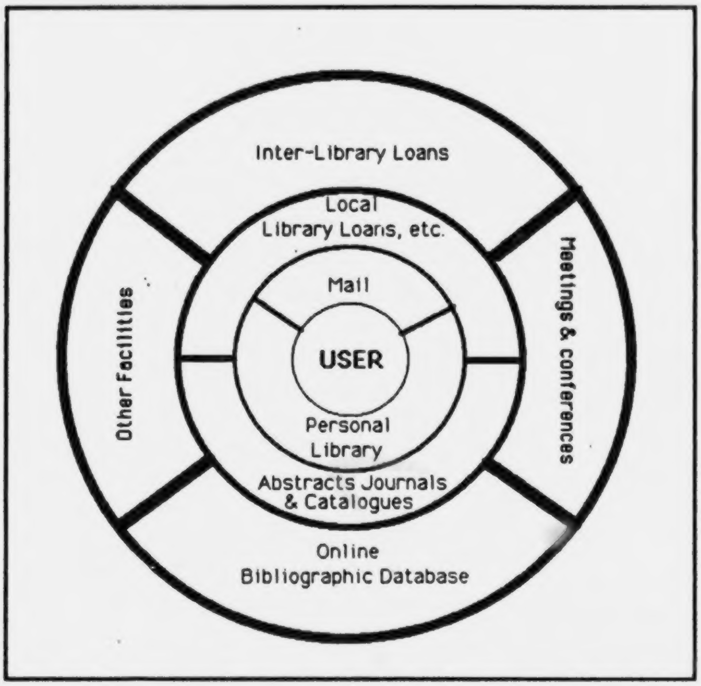
Inter-Library Loans
Local
Library Loans, etc.
Mail
USER
Personal
Library
Abstracts Journals
& Catalogues
Online
Bibliographic Database
Other Facilities
Meetings & conferences

Figure 3. Current User Access to Facilities

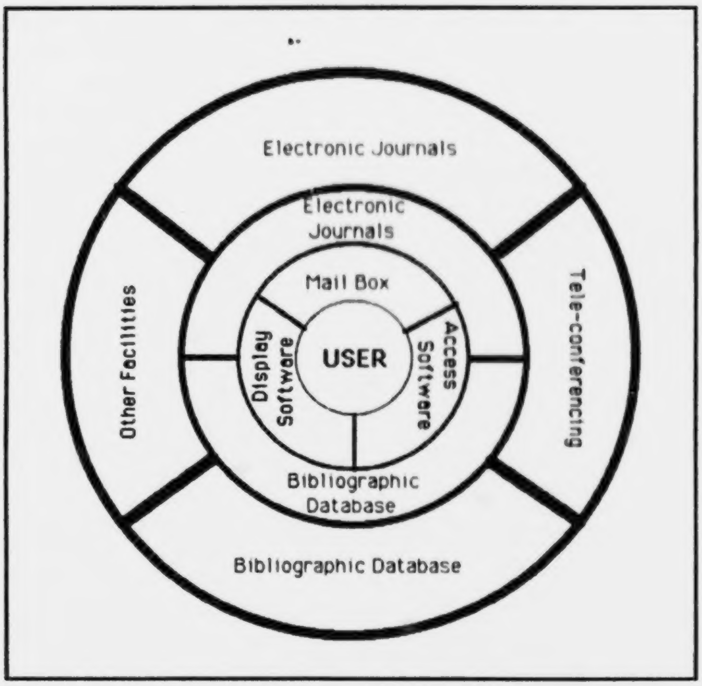
Electronic Journals
Electronic
Journals
Mail Box
Display
Software
USER
Access
Software
Bibliographic
Database
Bibliographic Database
Other Facilities
Tele-conferencing

Figure 4. Potential User Access to Facilities

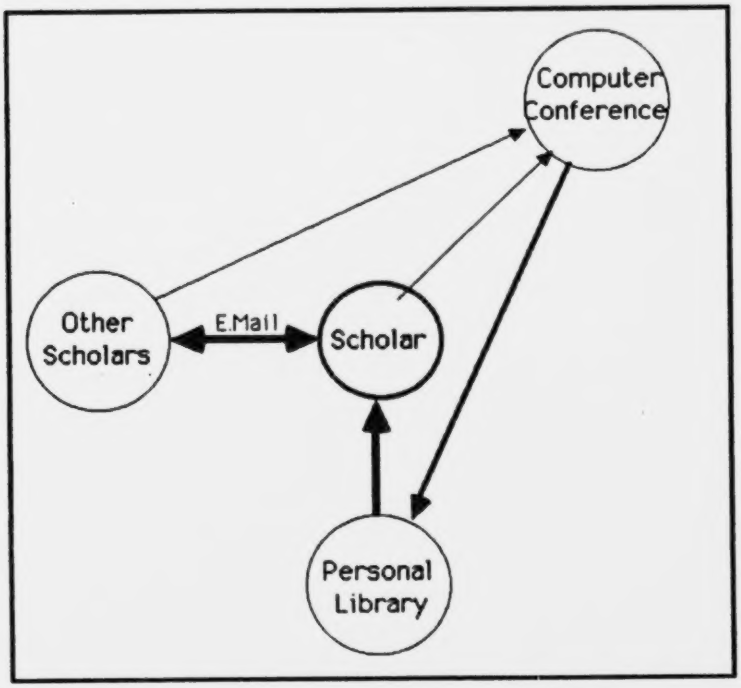
Computer Conference
Other Scholars
E.Mail
Scholar
Personal Library

Figure 5: Network of Scholars

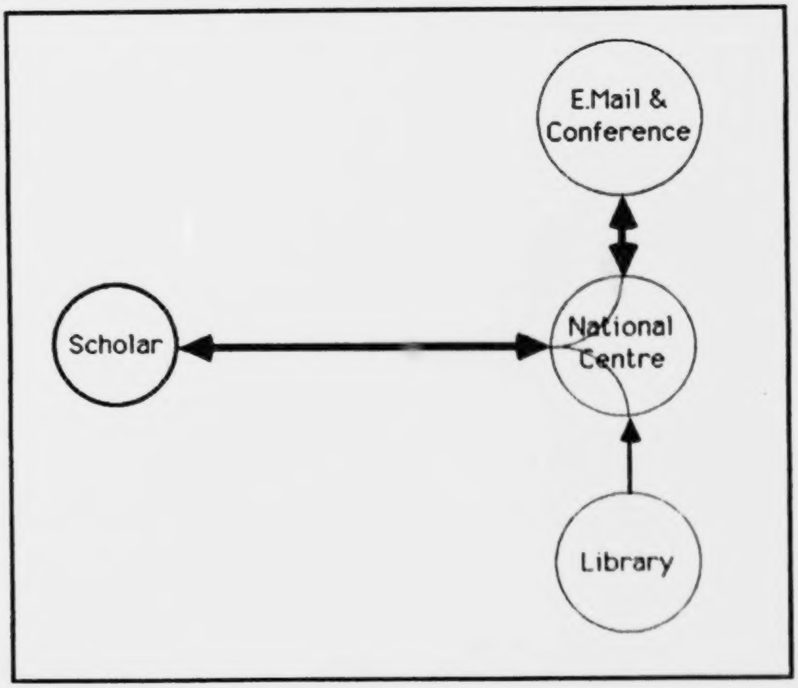
E.Mail & Conference
Scholar
National Centre
Library

Figure 6: Centralised System

2.2.3 Scenario 3: Hierarchical System

This is the scenario closest to the present structure (Fig.7). All components of the system are equally important and a local mail system is located on a local area network (LAN) and a conferencing system on the national system. The scholar could have direct or indirect access to the conferencing facility, but would only be able to obtain documents via the LAN. Such a system would provide an access bandwidth for documents somewhere between that provided by the previous two scenarios and would be particularly advantageous for student use, where a large number may be required to study certain articles before next week's lectures.

There remains the question of which information should be stored locally and which centrally. As most articles have very few readers it seems appropriate to store the primary documents on the central system, the bibliographic material locally; this could well be coupled with the additional possibility of down loading from the central store to a local read/write store for those documents that are known in advance to have a large readership. As with the preceding two scenarios, we assume the some external publishing mechanism exists whereby the various stores are updated.

Within this scenario it is possible to envisage a variant wherein the most frequently accessed material was stored on the LAN. This would decrease the total network traffic, but might introduce the problem of associating the (dynamic) discussion of documents with the static document, as it is most efficient to store such discussions in the central conferencing facility.

2.2.4 Scenario 4: Distributed System

In this last scenario (Fig.8) the central, national archive is removed and the primary and bibliographic material distributed to the LAN's. It is not envisaged that each of the LAN's will contain all the stored documents, since this would approximate to a large number of centralised systems (though without the easy conferencing facility) and so the possibility must be provided of inter-LAN file transfer. However, it is expected that this file transfer would be an infrequent activity and one which would require low bandwidth.

As in the previous scenarios the information store is updated regularly by an external publishing function, which could of course also reside on the network. This would be useful for the transfer of material to the publisher and any subsequent editorial processing but the distribution of accepted material could be carried out via some external mechanism in order to avoid over-loading the network.

2.2.5 Software and Communications Requirements

In none of the above scenarios have we more than hinted at the software and communications facilities that would be required. In all four scenarios there is a clear need for software to make documents acceptable for on-line viewing; however, the basic description of such a system is one of the outcomes of the BLEND study. Apart from this common facility, the requirements of all four systems are individual though there is no indication that any presents insuperable problems.

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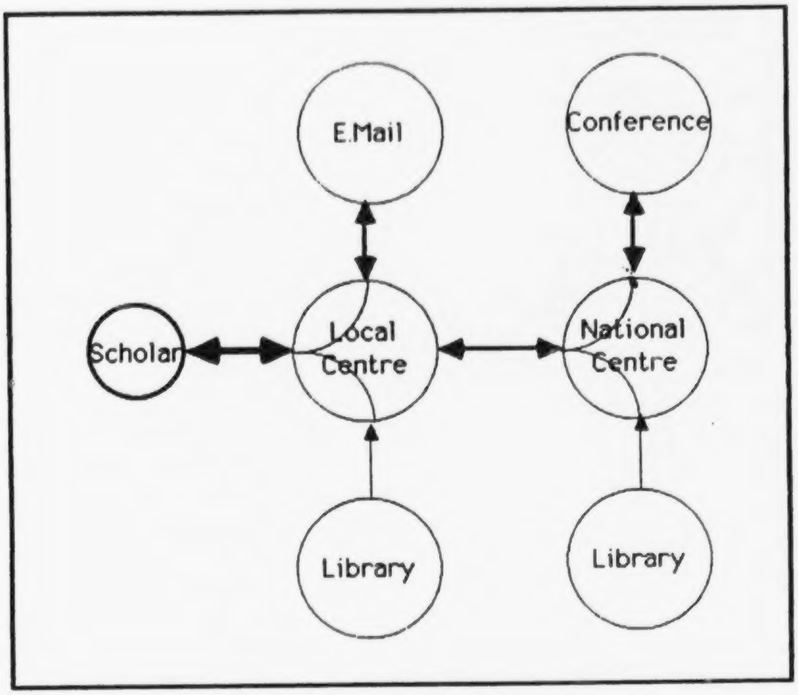
E.Mail
Conference
Scholar
Local Centre
National Centre
Library
Library

Figure 7: Hierarchical System

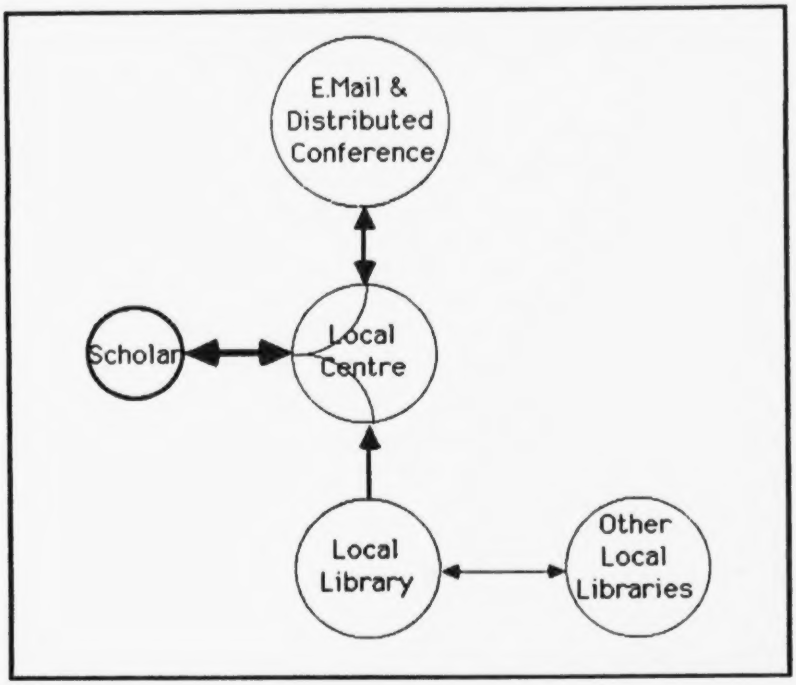
E.Mail & Distributed Conference
Scholar
Local Centre
Local Library
Other Local Libraries

Figure 8: Distributed System

3. THE EXPERIMENTAL PROGRAMME

The total programme consists of a set of related projects which are located in the four cooperating institutions and will be of various types. These types will include basic research, applied research and demonstration projects. The basic research will contribute both to the test-beds for the applied research and to the demonstration projects, which will link together several project components.

The demonstration projects are intended not simply to indicate capabilities but also to provide experimental test facilities. The BLEND project demonstrated that it was possible to develop and use an electronic journal system, but beyond a relatively small amount of tuning it did not provide much in the way of understanding regarding the best possible electronic journal system. In the current programme, we are concerned to provide such alternatives and to obtain indications regarding which alternatives are more appropriate to differently characterised user groups. By comparing such options one can learn much more than by looking at a single system. If this concept is extended to include the scenarios themselves each demonstration project should contain at least two different scenarios. For example, the storage aspect of the 'network of scholars' might be combined with the 'centralised' model to obtain a system that can be represented diagrammatically as shown in Figure 9.

This diagram introduces a number of assumptions, the major one being that the users would wish to communicate at both the formal and the informal levels; and for this reason we have included a conferencing subsystem to accommodate the informal communication. The formal side of the communication, roughly equivalent to journals and other print-on-paper publications, is envisaged as forming the "static databases", though this would of course be incremented at regular intervals.

In Figure 9 it is also assumed that the two subgroups of users have access to the same logical database but that in one case the database is located centrally and in the other the same database is directly attached to each user's workstation. However, for both groups the conferencing system is located centrally. This is both conceptually the simplest and would be a straightforward system to put into operation. Later models, or demonstrations, could modify this concept.

Figure 9 refers to a logical structure, not a physical one, and it is with mapping onto physical devices that we see the emergence of the component projects within the programme. For example one would need to consider the communication protocols that might be employed, the geographical distribution of the user groups, the storage technology for the static database especially for the workstations, the structure of the database including the integration of mixed mode documents, and the transparent association of the conferencing facility with the static database whether the latter be personal or central.

The composite scenario model presented above is not the only one that can be constructed, and the next demonstration that is envisaged would include the branch shown diagrammatically in Figure 10.

This subgroup structure could be incorporated and evaluated in conjunction with either of the two other subgroups, or with both if it were possible to locate a user group for which all three subgroups were relevant. It would probably be more difficult to set up the hierarchical subgroup structure and it is envisages that the conferencing facility might initially be located on the LAN with localized use for in-house documents before the more distant conferencing facility of Figure 9 was included.

Having built up the possible demonstration projects by adding components it is also possible to consider the effect of removing them. This could again give rise to structures more appropriate to particular user groups.

One possibility is to remove the conferencing facility, thereby producing a structure more akin to conventional publishing. It would be possible to compare two subgroups, one with and the other without the conferencing facility.

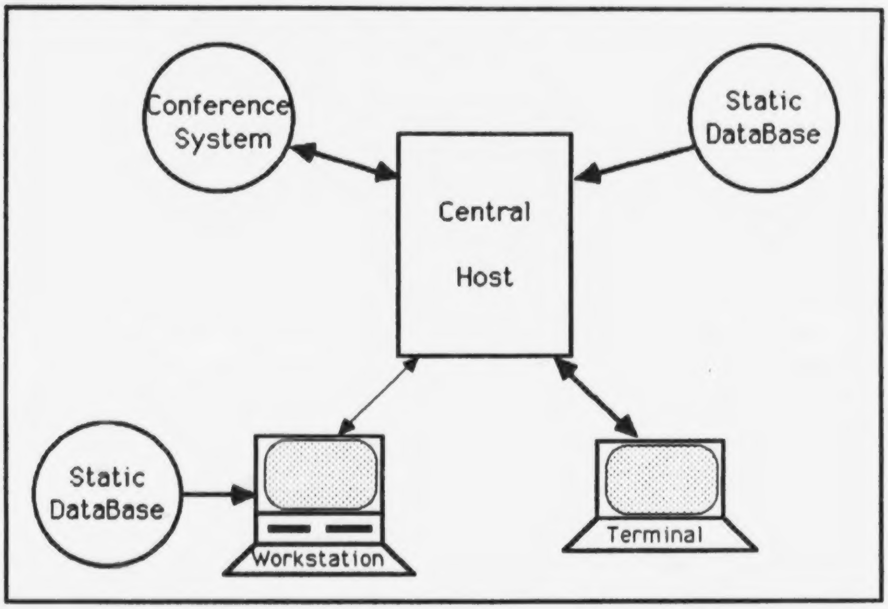
Conference System
Static DataBase
Central Host
Static DataBase
Workstation
Terminal

Figure 9: "Centralised" cf "Network of Scholars" user groups

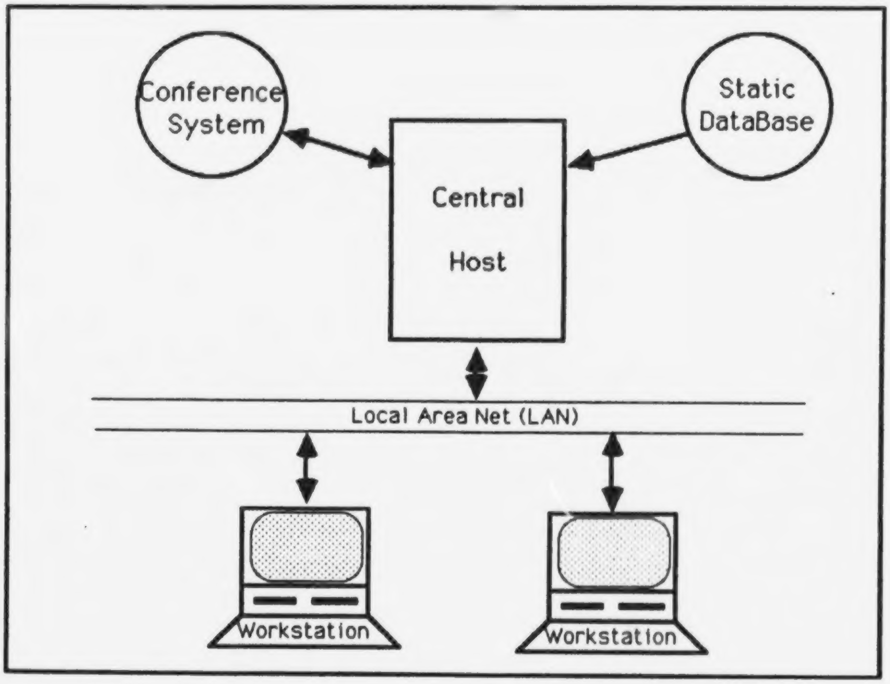
Conference System
Static DataBase
Central Host
Local Area Net (LAN)
Workstation
Workstation

Figure 10: Workstations and Hosts on a Local Area Network

There is a further structure without a conference facility that can readily yield important results; this is illustrated in Figure 11. Here one subgroup, whose only access to the formal static data base is via their own workstation, is compared with another subgroup who additionally have access to a more up-to- date database stored centrally. The rationale for such a structure is that the workstation database will only be incremented at regular intervals defined primarily by the packaging requirements of the distribution medium whereas the central database could be incremented whenever new information becomes available. The remote access will obviously cost more and a major research question is how much people will be willing to pay for the increased topicality of their information source.

There are many other variations that can be included within the programme, for example the addition of evaluative judgments to databases of abstracts, or the separation of the bibliographic and primary article database. However, these are variations that can be constructed from the same basic components, and the primary concern is to develop or acquire these components.

4. THE OVERALL PROGRAMME

The overall programme has been constructed by combining the elements referred to so far. These are:-

a) a modular system to allow for component replacement and development.

b) a related research programme feeding into the development of the system.

c) monitoring of developments external to the project which might influence the structure of the system.

d) experimental studies with communities of users in order to gain a quantitative assessment of the value of the value of the component facilities.

This combination is illustrated by figure 12, and is seen to consist of two phases which could be roughly described as "development" and "evaluation", though the activities will have considerable overlap. The development phase, lasting 12 to 18 months, will include the construction or acquisition of the basic components of the system to be used during years 2 and 3 of the three year programme.

Preparation for the evaluation phase will also start in year 1 with the location of suitable user groups and the development of evaluation methodologies, while development will continue into years 2 and 3 with the incorporation of the features too recently available to be experimentally evaluated in the user communities, but which might indicate future directions.

The system to be developed by such an approach is illustrated in figure 13, with the optional incorporation of the component facilities providing the mapping onto the various experimentation scenarios.

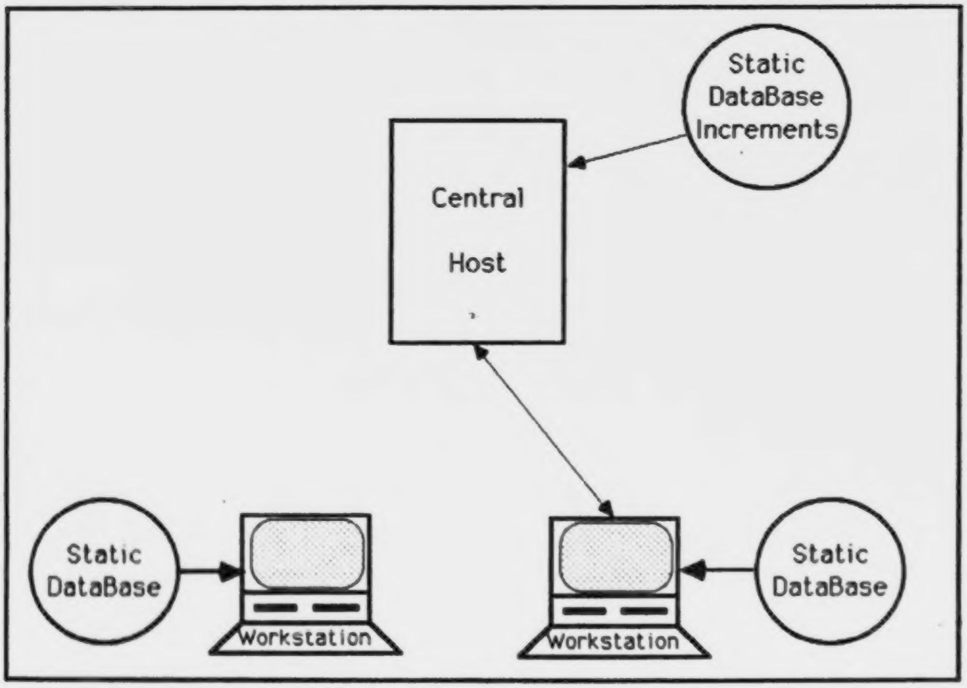
Static
DataBase
Increments
Central
Host
Static
DataBase
Workstation
Workstation
Static
DataBase

Figure 11: "Isolated" cf "Centrally updated" workstations

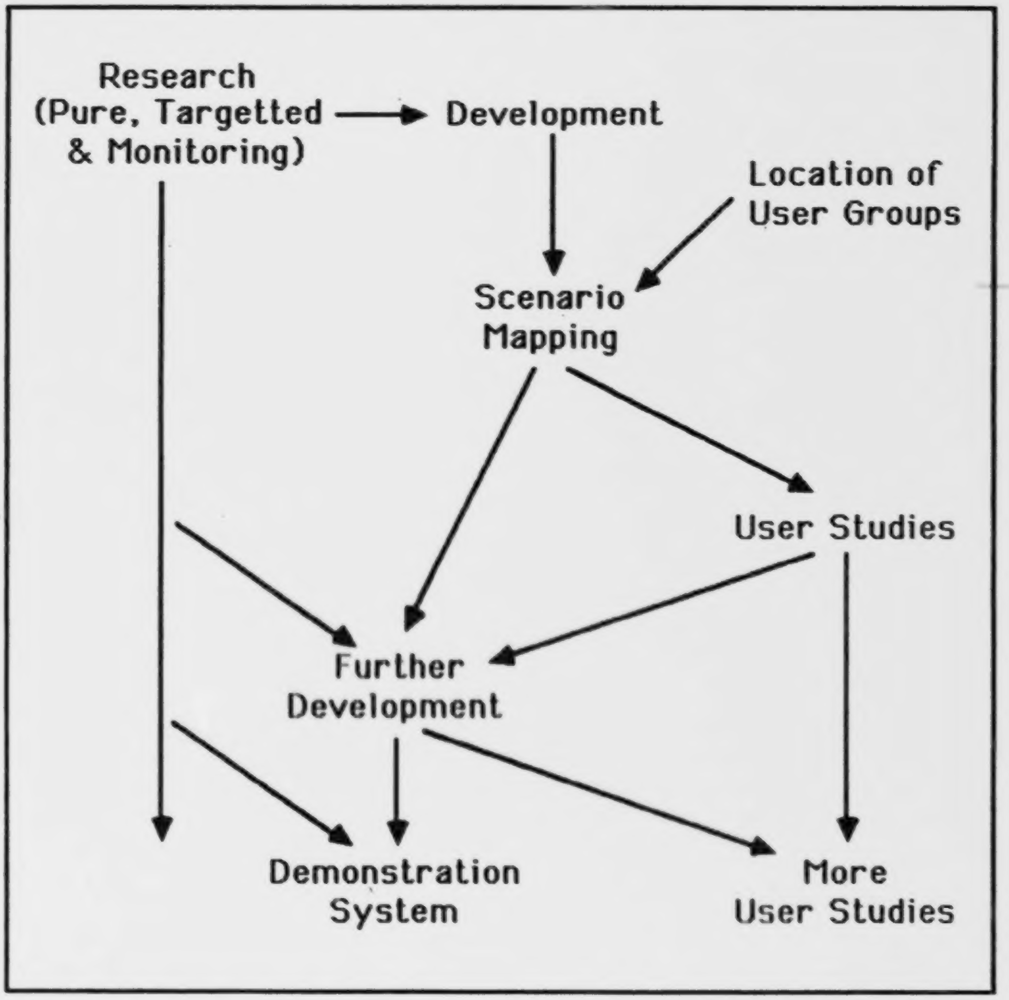
Research
(Pure, Targetted
& Monitoring)
Development
Location of
User Groups
Scenario
Mapping
User Studies
Further
Development
Demonstration
System
More
User Studies

Figure 12: TimeChart of the Overall Programme

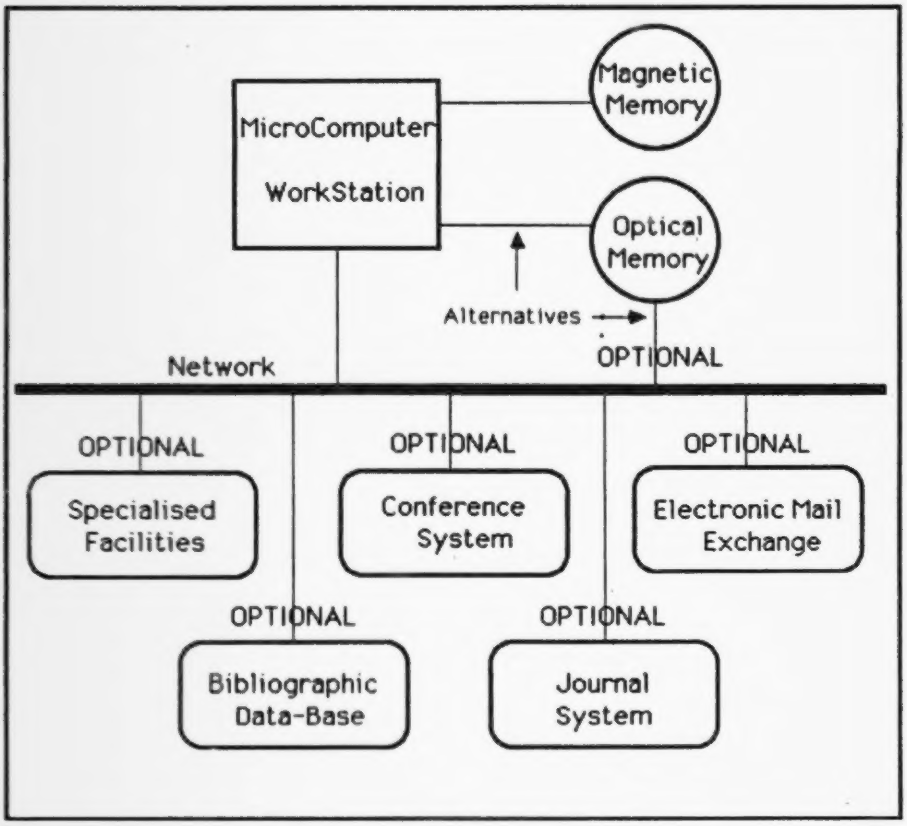
Magnetic Memory
MicroComputer WorkStation
Optical Memory
Alternatives
OPTIONAL
Network
OPTIONAL
OPTIONAL
OPTIONAL
Specialised Facilities
Conference System
Electronic Mail Exchange
OPTIONAL
OPTIONAL
Bibliographic Data-Base
Journal System

Figure 13: System Diagram

5. PROJECT AIMS AND OBJECTIVES

In summary the aim of projects:-

> to undertake a comparative evaluation of a number of alternative scenarios for information dissemination and exchange

and in order to carry this out, the project is divided into two major phases. These are 'system development', and 'system evaluation', which are envisaged to require approximately eighteen months each, with some degree of overlap. Within this overall structure the more detailed objectives of the project are:-

a) Assessment of the needs of users based on past experience, by advice from informed sources, and by exploratory studies.
b) Assessment of new technological advances in the fields of document creation, transmission, storage and display; e.g. ISDN and broad bandwidth transmission systems, Digital Optical Discs; and standardisation of electronic message systems.
c) Adaptation or development of, principally, software systems to provide test-bed systems suitable for the overall aims of the project.
d) Experimental evaluation of the reaction of individuals to these new systems, and their consequent refinement.
e) Field-testing of the derived systems for use in the learned community.
f) Demonstration of the potential to the LIS world of those technologies which are incorporated in the test-beds, and those which are not sufficiently widespread to be so incorporated.

ACKNOWLEDGEMENTS

The programme outlined in the document has resulted from discussions with a number of our colleagues, and we would like to thank in particular Bob Barratt, Peter Kistein and Brian Shackel. We would also like to thank our sponsors at the British Library Research and Development Department, notably Ann Clarke, Terry Cannon and Brian Perry for their continuing encouragement.

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AEDNET - A Single Discipline Network

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Second Symposium on Computer Conferencing and Allied Technologies
University of Guelph, Guelph, Ontario, Canada
June 1 - 4, 1987.

ABSTRACT

Adult education is growing as a discipline, and yet it is still fairly small in numbers of professionals. Perhaps no more than 15 - 20,000 professionals make a living with adult education. The Kellogg Foundation of Battle Creek Michigan, has recently granted funds for Syracuse University to develop an electronic network, AEDNET, for the purposes of linking such professionals in a multitude of ways. This network is now being developed.

The purpose of this paper will be to describe how such a network has been conceived and to discuss the progress to date in implementation. Planned features of AEDNET include the following:
1) Bulletin Board System for researchers and practitioners,
2) Dissemination of various types of information,
3) Electronic Conferencing,
4) Electronic Mail,
5) Collaborative Publishing at a Distance,
6) Quarterly Periodical,
7) Special Interest Groups SIG's For Information Exchange.

A further design of AEDNET is to share information with English - speaking adult educators that has been previously unavailable. Combined with the ability to share research results in adult education with educators worldwide, AEDNET is intended to be a path along which knowledge can be more rapidly transferred and applied to the needs of national and international users.

Future features being explored for AEDNET include:
1) An on-line adult education journal, .
2) An interactive search capability pertaining to a tremendous collection of adult education resources at Syracuse University,
3) International access, including Third World adult educators,
4) Exploration of using the system for facilitating an independent study Master's degree in adult education that is being developed at Syracuse University.

The presentation will include an on-line demonstration of what is available and a description of our future plans. The session will be interactive as well in that participants will be asked to provide input, feedback, and suggestions for improvement and future development.

Computer Conferencing for the Scholar, Researcher and Teacher

Dr. Micheal Spitzer
New York Institute of Technology

Second Symposium on Computer Conferencing and Allied Technologies
University of Guelph, Guelph, Ontario, Canada
June 1 - 4, 1987

ABSTRACT

New York Institute of Technology uses "Participate," a branching computer conferencing system, for a wide variety of educational applications, ranging from instruction to professional development. In my presentation, I will emphasize how computer conferencing is an effective way for scholars to share information, keep abreast of research in their fields, and collaborate on their own research and professional activities. I have been involved in computer conferencing with two distinctly different groups of professional educators, and will draw on this experience in my presentation.

With funding from the Exxon Education Foundation, 2 1/2 years ago I created a conference for college English teachers throughout the United States and Canada. Approximately 100 participants, all of whom use computers to teach writing, use the conference to discuss software design, teaching strategies, and related topics.

The New York State Education Department is funding another computer conference for Teacher Resource Centres throughout the state. Participants in these conferences discuss subjects such as effective teacher training, curriculum development, classroom exercises and availability of resources.

Participants in these various conferences have collaborated to write grant proposals, journal articles and proposals for presentations at professional conferences. Participants have experimented with synchronous conferences, the use of pseudonyms for anonymous conferences, and other techniques for stretching the boundries of a branching conferencing system.

As creator of the Exxon Conference and project director of the New York State Education Department conference, I have been able to study effective conferencing applications and techniques. My presentation will assess the effectiveness of computer conferencing for colleague - to - colleague communication. I will address the special requirements of moderating conferences among collegues, and pay special attention to the kind of user behaviour such participants demonstrate. As one example, I will focus on issues relating to ownership of ideas. When participants submit material that discloses research - in - progress, can they be assured that their ownership of this material will be protected? How can conference participants generate the mutual trust needed to promote free and open discussion?

Closing Remarks
by the
Symposium Chairperson

Dr. Elaine K. McCreary

Well, Ladies and Gentlemen, we have come to the end of our three and a half days together.

On behalf of the Steering Committee, I can assure you it has been a pleasure to host you here "chez nous". For this brief time we have been a community of common interest. We are living/breathing proof that mediated communication does not displace the satisfaction of direct communication.

We hope that each of you has found some sessions, some personal contacts to be stimulating, intriguing, provocative of new plans and schemes.

Though each of us is returning to home base, the support conferences will stay open, on-line, with complementary id's for 30 days. And we propose that we meet again for a reunion for our community at the Third Guelph Symposium in 1989. Nous vous invitons a revenir pour le Troisieme Symposium a Guelph en 1989.

Until that time we sincerely wish you God speed and safe travel...Au Revoir!

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